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AND STEAM ENGINEERING JOURNAL

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SEPTEMBER, 1897

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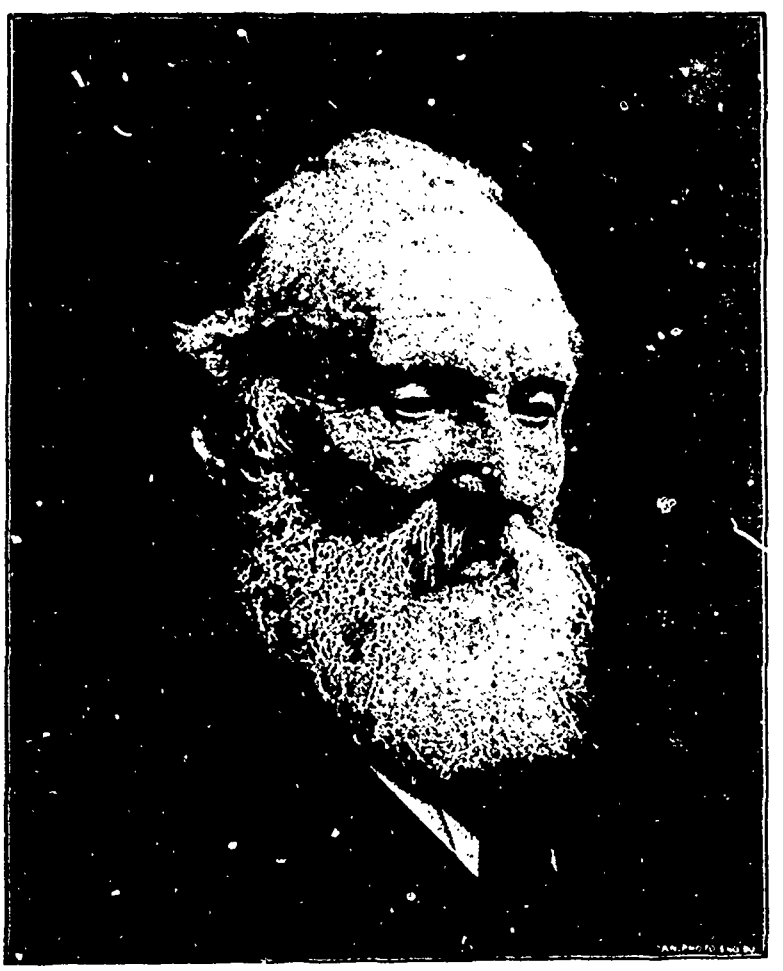


LORD KELVIN, M.A., D.C.L., F.R.S.E., Past President of the British Association.

PROF. OLIVER J. LODGE, D.Sc., F.R.S.

PROF. W. E. AYRTON, F.R.S.

MR. W. H. PREECE, C.B., F.R.S.

GROUP OF BRITISH ELECTRICIANS

BRITISH ELECTRICIANS.

On the previous page appear the portraits of several British electricians who were in attendance at the recent convention in Toronto of the British Association for the Advancement of Science. Lord Kelvin, long known as Sir William Thomson, is one of the most eminent scientists of to-day, and to him is due in no small degree the wonderful advancement which has been made in the development of electricity in recent years. He was born in Ireland in 1824, and graduated at several colleges. From 1846 to 1852 he was Fellow in St. Peters College, Cambridge, and since that time his life has been devoted to the progress of physical science. To telegraphy Lord Kelvin's services have been of peculiar value. He acted as electrician for the Atlantic cable, 1857-58 and 1865-66; he invented the mirror galvanometer and siphon recorder in connection with sub-marine telegraphy; he acted as electrical engineer for the French Atlantic cable, 1869; the Brazilian and River Plate, 1873; the West Indian cables, 1875, and the Mackay-Bennett Atlantic cables, 1879. He has invented a mariner's compass and navigational sounding machine, and many electrical measuring machines. His work has been of immense value in promoting commercial intercourse. The successful completion of the Atlantic cable in 1866 brought him knighthood, and in 1892 he was created a baron. Last year he celebrated his jubilee, which was a notable event in the world of science.

Professor Oliver J. Lodge was born in Staffordshire in 1851, and has been Professor of Physics in University College, Liverpool, since 1881. He has given considerable attention to electrical matters, and is the author of numerous publications, including "Elementary Mechanics," "Modern Views of Electricity," "Pioneers of Science," "The Work of Hertz and His Successors," and "Lightning and Lightning Guards."

Prof Ayrton is now in his fiftieth year. He is a Londoner, and entered the Indian Telegraph service in 1867, and afterwards pursued his studies under Lord Kelvin. When he went to India he became assistant to the Electrical Superintendent of the India Government Telegraph Department, returning on leave to England in 1872, and being employed on various matters relating to telegraphy, including the electrical testing of the Atlantic cable in 1873. On the establishment of the Japanese Imperial College of Engineering, he was offered the Professorships of Physics and Telegraphy, which he held until 1878. In 1884 Prof. Ayrton was appointed Professor of Applied Physics at the City and Guilds of London Central Institution. He is a joint editor of Messrs. Cassells' "Manuals of Technology," having written one of the series, "Practical Electricity," which has run through several editions. He gave a valuable lecture at Bath in 1888 entitled "The Electrical Transmission of Power."

Mr. W. H. Preece was born in Wales in 1834. He was appointed to the Electric and International Telegraph Co., 1853, becoming superintendent of the Southern Division in 1856. After attaining eminence in the telegraph world he was in 1870 transferred to the General Post-office as Divisional Engineer, in 1877 being appointed Engineer, and in 1892 Engineer-in-Chief, and is also Consulting Engineer to the Colonies. He has been associate author of text books on telegraphy and the telephone.

QUESTIONS AND ANSWERS.

Mr. "J. G." writes: I have been thinking of using my exhaust steam from lighting engine to heat our building, but do not know how to do it without putting on back pressure, which I wish to avoid. Our building is four stories high, and is piped on the two-pipe system, carrying steam at 15 lbs. I understand there is a system of exhaust steam heating, but the royalties charged are excessive, as far as I can make out. I would like to know if there is any other way, if not quite so elaborate as the patent way, may be. Details will be much appreciated.

Mr. James Johnstone asks: What would you advise me to do with my plant to bring down the temperature of my flue gases, as I find they are about 600° on entering the chimney, and this, I believe, is 200 too much. We use soft coal; common tubular boiler; fair draft; no forcing, and plant ample size; steam 85 lbs.

SIR, I would like if some of your readers could advise me as to what to do to keep the oil off a belt on the governor side of a high speed engine, and also what to do to extract the grease or oil from the belt. A handful or two of whitening I find to be a good thing to put on the belt when it slips badly, and will cure it for three or four hours. Sometimes I scrape it off (when running), but often I don't. (2) What advantage or disadvantage is there in raising or lowering the speed of a high speed engine? (3) When running a high speed automatic cut-off engine, which is the more economical pressure, at from 50 to 80 lbs.? Also, when running pumps and drying room coils and common 10 h.p. engine, I can carry anywhere from 40 to 80 lbs. Which is the best pressure, and why

"ONTARIO."

"Subscriber" writes: I have a flue about 20 feet long from my two boilers to chimney, and would like to have the opinion of others as to whether I could, by placing water pipes on the outside on top, get a high enough temperature in the water to be worth the trouble and expense. We use about thirty feet an hour for each boiler. The flue is extremely hot—must be about 400° to 500°. Is it possible that it might help to destroy the draught by cooling the flue and lowering the temperature inside? It is not too good at present. I would like suggestions in detail. How can I figure out to see if a 12 X 9½" Armington & Sims' engine, running at 280 rev., 80 lbs. steam, will drive 250 amperes at 115 volts?

James McPherson asks: Would some of the boys tell me what is the best kind of oil to use in the hydraulic cylinder of an elevator? Ours has not had any for four years, but I think it should get some.

[Readers of the ELECTRICAL NEWS are requested to forward replies to any or all of the above questions before the 28th of September, in order that the answers may appear in our October issue.—THE EDITOR.]

TO OVERCOME THUMPING.

SIR,—For the benefit of brother engineers I thought I would tell them of how I got over the trouble of a thumping in the water end of my pump, and hope it may be of use to some one likewise situated. In the first place, it was getting water under a head of about 30 lbs., and pounded frightfully, but when pumping out of the tank she would run all right. However, as we could only use the tank occasionally, we had to suit her to circumstances. Air chambers I stuck on in abundance, on both sides of pump and on top of tank 70 feet high, where she pumped to; I also placed one 5 ft. x 8" on pump in place of small original one. I put on strong springs on suction valves and throttled the head of water, but all to no purpose—pound she would. At last I put on a little air valve on the suction pipe, and throttled the water until she had to draw her water the least little bit, and then very slightly opened the air valve, when all at once the trouble ceased and the pounding was no more.

A. ALEXIS.

It is understood that the Cornwall Electric Street Railway Company are making arrangements to extend their line to the Ottawa & New York railway station, 1½ miles distant.

The corporation of Magog, Que., are installing a 1,000 light single phase alternator and other apparatus for their new incandescent lighting plant. The street lighting will be done by sixty 50 c. p. incandescent lamps, which are expected to furnish a much more satisfactory street lighting service than their equivalent of arc lamps. The apparatus is being furnished by the Canadian General Electric Company, of Toronto.

WESTERN ONTARIO LIGHTING PLANTS.

EXETER ELECTRIC LIGHT COMPANY.

The Exeter Electric Light Company was organized during the present year, through the efforts of Mr. R. C. C. Tremaine, who became manager. The plant, when completed, will consist of a G. E. 60 k. w. alternator and one 20 Royal arc machine, with usual switch board and instruments from the General Electric Company's works. The circuit is about 6½ miles in length. A boiler, 66 x 14, with eighty-four 3½ inch tubes, and a Brown engine, 14 x 36 feet, furnishes the power. The power house is a two-story brick structure, 34 x 80 feet, with stone foundations and smoke stack of iron, 60 feet high.

When Mr. Tremaine assumed charge a few weeks ago there were about 350 incandescent lights in use. At the present time a staff of workmen are busily engaged wiring an additional 900 lights.

Mr. Tremaine is a native of Nova Scotia. He was born at Dartmouth, opposite Halifax, on November 4th, 1874. After passing through the public and high schools he, in 1891, entered the School of Practical Science at Toronto, graduating as B. A. Sc. in 1894, and taking a post graduate course in 1895. In the summer of the same year Mr. Tremaine took charge of the electric

MR. R. C. C. TREMAINE.

light plant at Long Branch, which position he filled for two seasons, when he removed to Exeter and formed the present company.

DURHAM ELECTRIC LIGHT PLANT.

Messrs. Kilmer, Crawford & McIntyre are the owners of the Durham plant, which was installed just one year ago. The power house, situated on the Rocky Saugeen river at Aberdeen, four miles from Durham, is a substantial frame building, 20 x 40 feet, with metallic sidings. Power is furnished by a Barber 90 h. p. water wheel. The generator is from the works of the Canadian General Electric Co., being a 75 k. w. monocyclic, the switch board and instruments being from same firm.

This company have about sixteen miles of wire and over 900 lights, and will shortly install a number of 50 c. p. street incandescent lights.

MOUNT FOREST ELECTRIC LIGHT PLANT.

The electric light was first introduced in Mount Forest in the year 1885, the present owners, Messrs. Corley & Collins, purchasing the plant from the former owners in 1890, and running only an arc system until 1893, when they installed an incandescent plant.

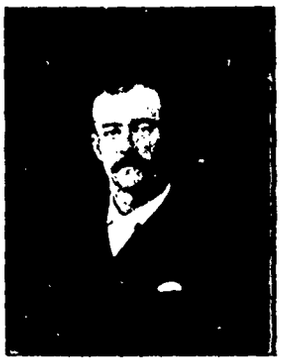
The power house is centrally located. Steam power is supplied by a Wheelock 140 h. p. engine and boiler, operating a 500 light National generator for incandescent system, 20 light Ball arc machine, 2000 c. p., with switchboard fitted with National instruments.

This company have 14 arc lamps and 350 incandescent lights installed, and are about to increase the number.

Mr. T. H. Collins acts as manager, and under his supervision an excellent service is being furnished.

CHESLEY ELECTRIC LIGHT PLANT.

This plant, owned by Mr. R. T. Bearman, is under the management of Mr. J. H. Fry. The power house is situated on the north branch of the Saugeen river, about 1½ miles from the town. Power is supplied by two turbine water wheels of 100 and 50 h. p. There are over eight miles of wire, and there are installed 300 incandescent lights, 34 arc street lamps, and 25 50 c. p. street incandescent lamps. The generators are a 500 light Reliance and a 25 and 35 Reliance arc machines, with full complement of instruments.

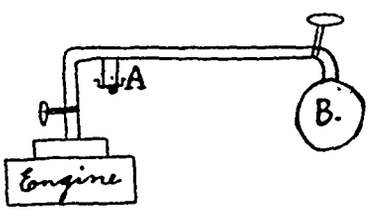


MR. J. H. FRY.

Mr. J. H. Fry, the electrician in charge, is a native Canadian, born near Port Hope, May 30th, 1864. He has been in charge of the present plant for over six years.

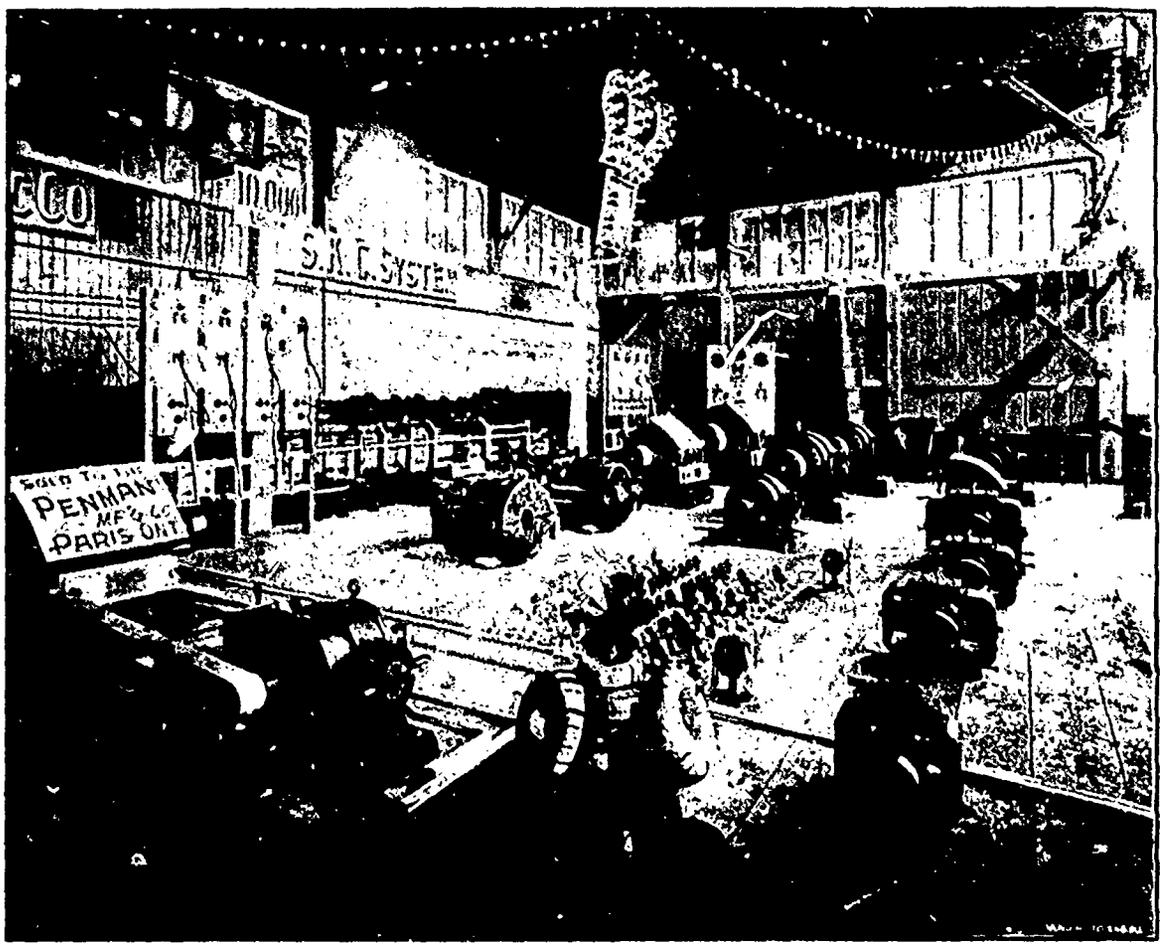
BOILER ACCIDENT AT LONDON.

LEONARD J. Grimshaw, a machinist employed by E. Leonard & Sons, of London, was killed in Watson's box factory recently. He was engaged putting in a new high speed Ball engine, and had started up steam before work on the engine was completed. The cap of the drip attached to the pipe used to conduct steam from the boiler to the engine blew out a short time after the engine was started. Deceased was standing right under the drip at the time, and was covered by the condensed steam. The force of the explosion sent him

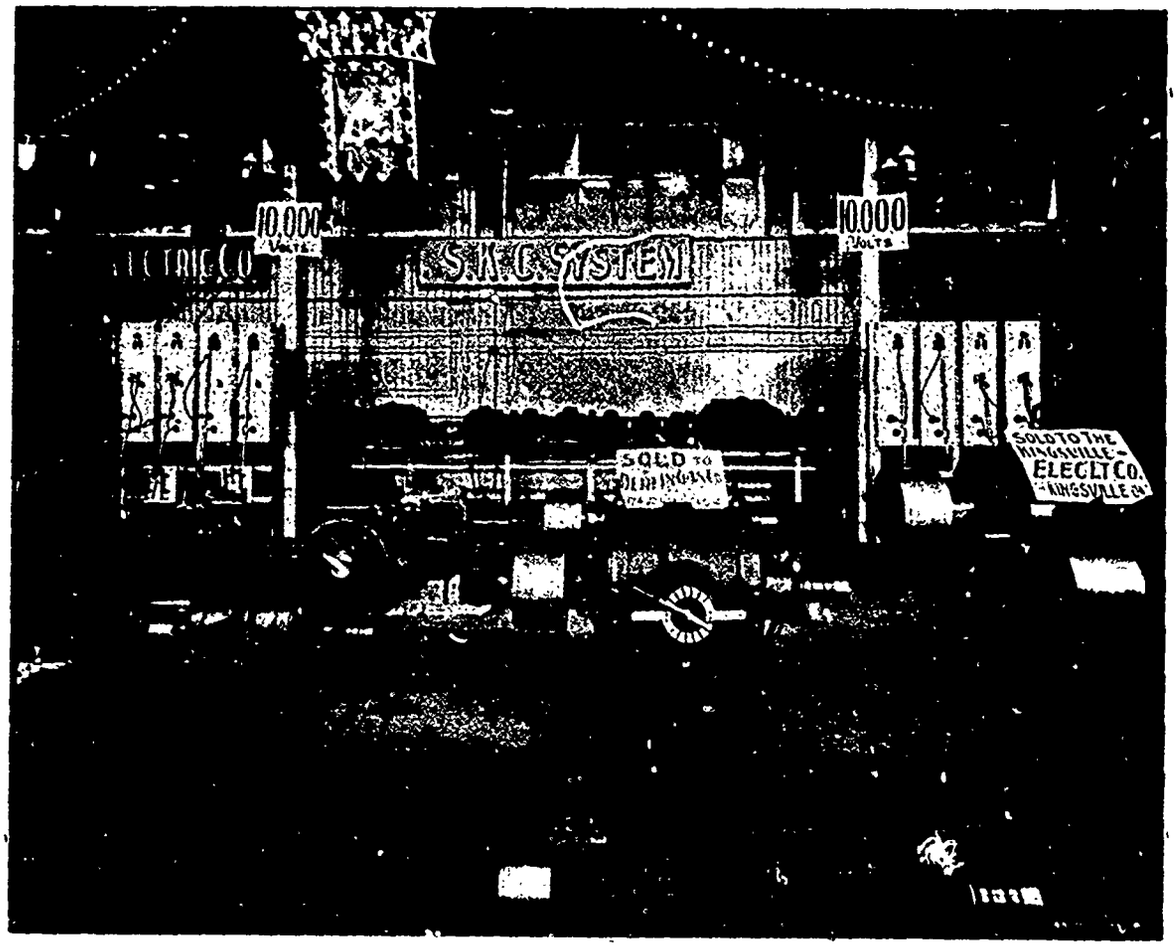


into a small hole about ten feet away. In the accompanying illustration, showing how the accident occurred, A is the drip pipe, with a cap (cast iron) at the end, tapped for ¾ or 1 inch pipe, and B the steam boiler. The pipe connections for drip had not been made at time of accident. The metal of the cap at bottom was 7/16 inch, and the bottom blew clean out, but the thread never stripped. The steam pipe and drip were five inches in diameter.

The Doherty Organ Company, of Clinton, requiring an increased dynamo capacity, have placed an order with the Canadian General Electric Company for a 200 light incandescent machine of the Edison type.



General View of the Exhibit of the Royal Electric Company at the Industrial Exhibition, Toronto, September, 1897.



View of the Exhibit of the Royal Electric Company at the Industrial Exhibition, Toronto, Showing the High Voltage Transformers and Special Switch-Boards.

EXHIBIT OF ELECTRICAL APPARATUS.

One of the most interesting and unique exhibits at the Toronto Industrial Exhibition now in progress is that of electrical apparatus. There is a noticeable improvement in the display as compared with former years, although a number of the manufacturing companies are not represented. The growing interest in electrical apparatus is attracting many visitors to the east wing of Machinery Hall, where the exhibit is located. Each company has sufficient space to permit of the proper and most advantageous arrangement of the machinery, and the effect produced in the evening by means of the many colored lights is pleasing in the extreme.

The Royal Electric Company, of Montreal and Toronto, has practically two exhibits. Near the centre of the hall are located two Leonard engines of 60 and 100 h.p. The larger engine drives two Royal Electric Thomson-Houston 50-light arc dynamos, belted in tandem, these machines being used for lighting the machinery hall and other buildings. Belted to the 60 h.p. engine is an "S.K.C." two-phase generator, and set up near by is a switchboard complete. Behind the switchboard there are connected up two large transformers, which take up the full capacity of the machine. This generator furnishes the current for about 400 colored incandescent lights arranged over the company's exhibit in another part of the building. The above portion of the exhibit may be said to represent a thoroughly equipped central station, including arc and incandescent lights and motors complete.

Passing to the extreme east end of the building, we reach what may be termed exhibit No. 2. Here the 400 incandescent lights above referred to are arranged in festoons near the ceiling over the company's exhibit in such a manner as to give the most pleasing effect. In the centre is a crown of about 150 lights, while extending from the crown to the four corners of their space are rows of colored lights, numbering in all about 250. They have also on view twelve alternating current arc lamps, among them being some that burn 100 hours with one carboning.

On a large table is displayed a complete line of electrical supplies, while a pyramid of Royal sterling rubber covered wire is also to be seen. The machinery here exhibited includes a range of the well-known S.K.C. transformers, ranging from a miniature of 10 lights to one of 1200 lights capacity; a range of S.K.C. generators and motors, operating on the two-phase system, from 2 to 50 h.p., with switchboards; direct current four-pole dynamos and motors, and their latest type of street railway apparatus. A special feature of the exhibit is the high voltage transmission line, the current being generated at 2,000 volts and raised by means of step-up transformers to 20,000 volts, at which pressure it is conducted over high voltage insulators on the model pole line and again stepped down from 20,000 to 2,000 volts, and used in the regular S.K.C. transformers to illuminate the building. This portion of the exhibit is particularly interesting, inasmuch as the Royal Electric Co. are making a specialty of high potential work and long distance transmission, and this display is intended to illustrate a complete long distance transmission and distribution line.

By a specially constructed switchboard the danger to operators in transmitting under a pressure of 20,000 volts is entirely removed, as the switches are so arranged that there is no possibility of "arcing across" so frequently occurring in high voltage work.

In connection with the display of the Royal Electric Company, it may be noted that a type of every electrical machine made is exhibited. The principal feature noticeable is the tendency to do arc and incandescent lighting, as well as all kinds of power work, with alternating current, and judging from the various sizes of alternating and induction type motors shown, there appears no hesitancy about putting them on the market and guaranteeing results. Some conception of the magnitude of their exhibit may be obtained from the fact that four car loads of machinery were brought up from the factory in Montreal for the purpose, the work of erecting the same being done under the supervision of Mr. James Fleet, the company's expert.

Entering the Machinery Hall from the south, we find on our right an attractive exhibit by the the W. A. Johnson Electric Company, of Toronto. An Ideal engine, manufactured by the Goldie & McCulloch Company, is driving two 110 volts direct current incandescent dynamos, operating on the three-wire system, furnishing current to incandescent and long burning arc lamps, and supplying incandescent lights for the main building and for operating the cinematographe. A 250-volt power generator drives several motors in different buildings. The exhibit of the company also includes the renowned Wagner transformers, enclosed long burning arc lamps, alternating and direct current ceiling fans, two arc light dynamos in operation for illuminating the main building, and their new 600 light inductor alternator. All the above apparatus are provided with full switchboard outfits, the whole having been manufactured at the Toronto factories of the company, and making a creditable exhibit.

The Kay Electric Manufacturing Company, of Hamilton, and the Jones & Moore Electric Company, of Toronto, each have well-arranged exhibits of dynamos, motors, lamps and general supplies. The former company has also on view a complete switchboard. The motors of the Jones & Moore Electric Company are painted white, presenting a neat appearance.

The special feature of the exhibit of the Toronto Electric Motor Company is their direct connected generators, which are claimed to be the first of the kind ever placed on exhibition in Canada, and from the number of persons who inspected the apparatus it was evident that the innovation was appreciated. A 30 k.w. dynamo is direct-connected to an Ideal engine of 60 h.p., running at 300 revolutions per minute. This generator, together with a complete switchboard, comprising a 600 light plant, was manufactured for the Methodist Book & Publishing Company, and will shortly be installed. There is also shown a smaller dynamo of 15 k.w., connected to a 20 h.p. Ideal engine, running at 550 revolutions and furnishing 110 volts. Motors from ½ to 12 h.p. and arc lamps complete the exhibit. Arc and incandescent lighting and power are furnished from the same machine, and the economy in space by use of the direct-connected generators was freely commented upon.

The Shelby lamp is exhibited by the John Abell Engine Company, who have recently obtained the Canadian agency for these goods.

Owing to the convenient location of their large show rooms on Front street west, within one minute's walk of the Union Station, the Canadian General Electric Company made no exhibit at the Exposition. Many visitors to the city were shown through their immense warehouse, where everything in the line of electrical apparatus could be seen.

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

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TORONTO—A. E. Edkins, A. M. Wickens, E. J. Phillips, F. Donaldson, J. Bain,
HAMILTON—R. Mackie T. Elliott.
BRANTFORD—A. Ames, care Patterson & Sons.
OTTAWA—Thomas Wesley.
KINGSTON—J. Devlin, (Chief Engineer Penitentiary), J. Campbell.
LONDON—F. Mitchell.
NIAGARA FALLS—W. Phillips.

Information regarding examinations will be furnished on application to any member of the Board.

The Sarnia Tunnel.

THE Great Northwestern Telegraph Company have removed once for all the annoyance and expense occasioned by the destructive action of acid upon their wires in the Sarnia tunnel, by enclosing them in a lead cable. Under the direction of Mr. A. B. Smith this new cable, encased in a wooden conduit, has been laid in a trench eighteen inches underground, alongside the railway tracks. The cable measures over 6,000 feet and weighs about 18 tons.

Steel Standards for Boilers.

ALL steel used for boilers of steamships constructed under Lloyd's rules is now required to have an ultimate tensile strength of not less than 26 tons, and not more than 30 tons per square inch of section, and the ultimate elongation must not be less than 20 per cent. in a length of 8 inches. It is to be capable of being bent to a curve, of which the inner radius is not greater than one and a half times the thickness of the plates or bars after having been heated uniformly to a low cherry-red, and quenched in water at 82 F.

Growth of Electric Lighting.

IN the towns and villages of Ontario it is gratifying to observe the rapid growth of electric lighting, both for public and private use. New plants are constantly being installed in places where coal oil and gas has heretofore been the only illuminants, and frequent extensions to circuits are rendered necessary by the growing appreciation of electricity in places where this system of lighting has been employed. While the greatest advancement in this direction has been made in Ontario, it is by no means confined to this province. Throughout the entire Dominion the outlook for the electric lighting business is somewhat encouraging. In the maritime provinces many saw mills have recently been equipped with isolated plants, by means of which night

work is permitted, and it is thought that this branch of the industry will be considerably extended in the near future. These statements will, we believe, be borne out by the electrical manufacturing companies, who have enjoyed a comparatively good business during late years when commercial depression was almost general. True, the cost of electrical apparatus has been much reduced within a short period of time, leaving a smaller margin of profit to the manufacturer, but this has in a measure been offset by the greater volume of trade. A still wider adoption of electricity for lighting purposes will be witnessed before the close of the nineteenth century.

Electric Motor-Cabs.

While in European countries gas and steam-motor propelled vehicles for road purposes have attained the greatest degree of success, experiments made in America would seem to be in favor of electricity as the motive power. The Electric Carriage and Wagon Company have inaugurated in New York city an electric-motor cab and carriage service, which is said to be meeting with much success, the power being furnished by storage batteries. Results show that about 1.25 horse power is necessary for the propulsion of 2,000 pounds over ordinarily approximately level roads at ten miles per hour. During the month of June 1,580 passengers were carried by these cabs a distance of 4,603 miles. The rates charged are one dollar for the first two miles or any part thereof, and 50 cents for each extra mile. It would appear that the field for the electric carriage was gradually widening.

The Progress of Science.

No better illustration could be found of the rapid strides which have been made of late years in the field of science than is afforded by a perusal of the proceedings of the British Association for the Advancement of Science, which for the first time in its history convened in Toronto in August last. To the city it was a source of congratulation that men who are so prominently identified with the progress of Great Britain should have assembled in Toronto in such large numbers. It is said that general surprise was expressed at the beauty of the Canadian cities visited, as well as at the abundance of natural resources possessed by the Dominion of Canada. As these impressions are made known throughout the countries of Europe, benefits to Canada are likely to follow. It was pleasing to observe that of the various branches of physical and natural science, that of electricity received perhaps greater attention than any other. There were present at the meeting a number of well-known electricians, who took an active interest in the proceedings. A paper of more than ordinary value was read by Prof. Ayrton, entitled "Some Tests on the Variation of the Constants of Electricity Meters with Temperature and Current," the author being Mr. G. W. Donald Ricks. The discussion following showed that an opinion existed that electric meters register more accurately than gas meters, but that there is still much room for improvement in them. There is a growing demand for a meter that will work accurately and can be purchased below the present cost. Some other papers of electrical interest were: "On a Method of Determining the Specific Heat of a Liquid in Terms of the International Electric Units," by Prof. H. L. Chandler and H. T. Barnes; "On the Fuel Supply and Air Supply of the World," by Lord Kelvin; "On the Constitution of the Electric Spark," by Arthur Schuste; "An Electric Curve Tracer," by Prof. G. B. Rosa; "On the Source of Luminosity in the Electric Arc," by Henry Lerew and Mr. Basquin; "The Sensibility of Galvanometers," by Prof. Ayrton and Prof. J. V. Jones; "On Some New Forms of Gas Batteries and a New Carbon Consuming Battery," by Willard E. Case. A paper by Mr. G. C. Cunningham, late manager of the Montreal street railway, was also read.

An Immense Water Power Scheme.

Steps have been taken by the St. Lawrence Construction Company, composed largely of British capitalists, to carry out an immense electrical water power development scheme at Messina, N. Y. Near this point the St. Lawrence river runs through a series of rapids, and in the course of seven miles there is a fall of 56 feet. About three miles from these rapids there runs the Grass river, some 300 feet wide, which takes its course through a gorge nearly 50 feet deep. It is proposed to cut a canal through the level plateau and to establish a power house on the banks of the smaller river. The water would be delivered upon turbine wheels with an absolute head of over 40 feet, and after actuating the turbines, would flow through the valley of the Grass river and re-enter the St. Lawrence below the rapids. The canal is intended to develop 150,000 horse-power, of which one-half will be rendered available in the first instance. Contracts for the entire work have been let, and the company hope to have the undertaking completed by December, 1898. The electrical apparatus, including fifteen 5,000 h. p. generators, are being manufactured by the Westinghouse Electric and Manufacturing Company, of Pittsburg. Each generator will weigh about 350,000 lbs., and will stand 22 feet high above the top of foundations. It is estimated that the entire plant and canal will cost in the neighborhood of two million dollars, and that power can be sold at fifteen dollars per horse power per year, running twenty-four hours.

OUTLOOK FOR MECHANICAL ENGINEERS.

W. S. G. writes: May I ask as a favor your opinion as to what the prospects are for those graduating in Electrical and Mechanical Engineering at the School of Practical Science, Toronto? I have seen in your paper opinions both optimistic and pessimistic. Those opinions apply, however, to those graduating as Electrical Engineers. Has not the graduate in the above course also open to him the field in Mechanical Engineering, including draughting, designing, inventing, etc.? I am contemplating taking the above course, but feel that my knowledge of what the profession is, what it includes and what the prospects in it are, is not definite enough. I have always had a liking for applied science and machinery, and have confidence of success along this line. Prof. Galbraith says, "Success depends on the special fitness of the candidate for his chosen vocation." I am at present at home on my father's farm, but, as I said, am contemplating taking this course, and would appreciate very much your opinion and advice.

Answer.—It is a difficult matter to advise you as to the course you should pursue in the absence of knowledge of all the circumstances of the case. Speaking in general terms, however, we would say that the engineering colleges appear to be turning out a larger number of graduates than the employment in this line would seem to warrant, and there are many competent engineers, civil, mechanical and electrical, who are unable to find employment at salaries commensurate with their abilities and the expense connected with their education. In view of these facts, you should give the subject careful enquiry and consideration before deciding to enter the field, as it seems to us it is only those who are favorably circumstanced, as to means, education and natural fitness, who can reasonably expect to achieve any large measure of success. Our opinion is that too many young men are forsaking good homes on the farm to enter commercial and professional lines. We believe that a young man who understands farming in a scientific manner and has some means at his disposal with which to make a start, is more likely to secure a comfortable living and a fair competency than the one who comes to the city and takes a professional course.

NEW BUILDING AND EQUIPMENT OF THE BELL TELEPHONE COMPANY, MONTREAL.

This company's new building, at the corner of Notre Dame and St. John streets, Montreal, contains the head office, eastern and local department offices, electrical engineering department, main exchange, distributing room, power room, and various other departments, including the Montreal agency. The Merchants Bank of Halifax occupies a large portion of the ground floor; the Royal Victoria Insurance Company and the Northern Electric & Manufacturing Co., Limited, have offices on the first floor, and the first and third floors are laid out principally for offices to be rented. A corridor ten by one hundred and thirty feet (10' x 130') long runs from Notre Dame street to Hospital street, with a large vestibule at each entrance. Off this corridor are the entrances to the elevators, stairways, Montreal agency, long distance booths and the banking room. The bank is large, commodious, handsome and well arranged, the room being thirty-six ft. wide by one hundred and twenty-two feet long.

The vault in the bank was built by Messrs. J. & J. Taylor, Toronto, and is one of the most expensive and strongest safety deposit vaults ever built in Canada. The door of the vault, including the bolt work, is over a foot thick, made of chrome steel, according to the most modern practice in safe construction, and the walls, floor and ceiling are all of strength and thickness proportionate to the door. In connection with the vault are examining boxes for depositors and a book vault. There is also a directors' room, lunch and coat rooms, and a lavatory.

Bell Telephone Co. Head Office and Main Exchange, Montreal.

THE BELL TELEPHONE COMPANY'S OFFICES.

The whole of the second floor is divided into offices for the company, which also occupies a portion of the third floor. The board room on the second floor is 18' by 28'. This room, together with the president's office, occupies the Notre Dame street frontage on this floor. The other offices on this floor are the general office and those of the secretary-treasurer, stenographer, general superintendent and special agents. There are also book vaults.

On the third floor are located the engineering department, drafting office and testing department, power room, photographic dark room and long distance test room. The operating room, which is 36 feet wide by 110 feet long, and 18 feet high, is on the fourth floor. It is lighted with large windows on all sides, and has a large prismatic skylight in the roof.

In order to protect the telephone apparatus in this room from fire, which would mean an enormous loss to both the company and the business community, it was necessary to construct the most fire-proof building possible. The floors, roof and walls are all made of incombustible material, and every window on the floor is provided with rolling steel shutters. The skylight over the operating room is of double thickness, and nothing has been omitted to guard and protect the whole from fire.

Off the operating room is the operators' lunch and reading rooms, a locker room, a lavatory, a steam clothes dryer and bath room. The rest of the floor is taken up by the janitor's quarters.

In the basement the underground wires enter the building at three points. They are assembled in the distributing room, and from thence pass to the operating room in a fire-proof shaft. In the basement also are located the linemen's room, store room, engine room and boiler room.

The heating apparatus of the building consists of two Babcock and Wilcox boilers of the latest pattern; two immense Sturtevant steel fans and independent vertical engines; a large steam coil, which draws the fresh cold air from an open court, heats it and forces it under pressure to every room in the building, and the vitiated air is exhausted through the corridors and elevator shaft, through roof ventilators and back to the outside entrance. The air, before delivery, is filtered, washed and dried, and is changed throughout the entire building once every eight minutes. The building is completely lighted by both gas and electricity, all the electric light wires being run in armoured conduits. There are two hydro-steam elevators.

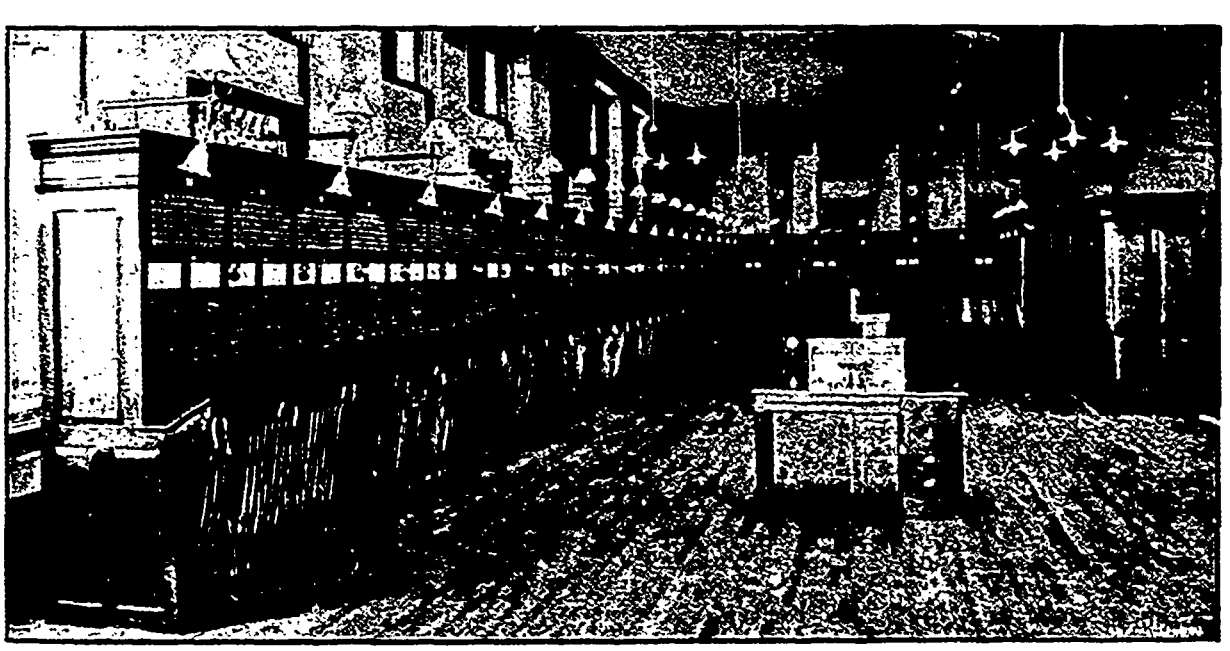
The exterior walls are of brick and terra cotta, these being the best fire-resisting materials known for the purpose. The ground floor is of red terra cotta, the rest of the building being of buff brick and terra cotta.

With regard to the electrical features, commencing at the basement the subscribers' lines enter the building in cables of two hundred wires each, all cables entering underground. The cables are hermetically sealed into

iron terminals, or cable-heads, and the various pairs of wires are led to binding posts mounted on the sides of the cable-heads, but insulated from it. The cable-heads are secured to an iron-supporting framework of ingenious design, ample provision having been made for future increase. Close to this framework is the "main distributing frame," which is also an open iron framework, somewhat resembling the cable-supporting apparatus. To one side of this frame are connected the underground cable-heads by means of small cables de-

somewhat more complicated, consisting of a small coil of German silver wire, wound on a hollow brass spool, a short metal rod passing through the hole in the spool, being held in place by a drop of fusible alloy, the whole mounted in a rubber case. This contrivance is held between two springs. When a current greater than the apparatus will stand, commences to flow in the circuit, the spool heats, melting the fuse metal and releasing the pin, and this allows the line to ground, cutting off the heavy current from the office.

BELL TELEPHONE CO.—GENERAL VIEW OF OPERATING ROOM SHOWING LOCAL AND LONG-DISTANCE SWITCHBOARDS.



BELL TELEPHONE CO.—VIEW OF LOCAL SWITCHBOARD.

signed for indoor work, while to the other side is connected the cables leading to the switch room. On the side of the rack to which are connected the outside cables are mounted the lightning arrestors and "sneak" current protectors, the combination being well-known, technically, as style Number Four. The lightning arrester consists of two plates of carbon separated by a ring of mica; lightning or other high potential currents will jump the air gap to ground without passing through the switch proper. The sneak current protector is

The two sides of the main frame are connected by separate pairs of "jumper" wires, a special "flame-proof" insulation being used. At this frame are made all changes due to new work, removal of instruments, changes in location of instruments, and, in fact, all causes.

OPERATING ROOM.

Leaving the main frame the lines pass, in cables, upstairs to the fourth floor, where the switch room is situated. Here the cables are connected to the inter-

mediate distributing frame, which is very similar to the frame down-stairs. This frame is used as a connecting point between cables from the main frame and cables to the switch board. Changes can be made here in order to rearrange the lines coming to any operator, for the purpose of equalizing the calls she will have to answer. For instance, if at a certain season of the year a particular line is used much oftener than usual, this line can be taken from the regular operator and put on another operator, who has fewer calls to answer, thus balancing the work.

The switch-board proper is of the "branch terminal multiple" type, wired for 3,600 lines and having an ultimate capacity of 4,800 lines. At present 2,500 lines are working in this office. The number of lines an operator can attend to depends on the number of calls per line. In addition to the local positions there are several operators who receive calls from the branch offices and the long distance switch. All switchboard circuits are metallic throughout the switch.

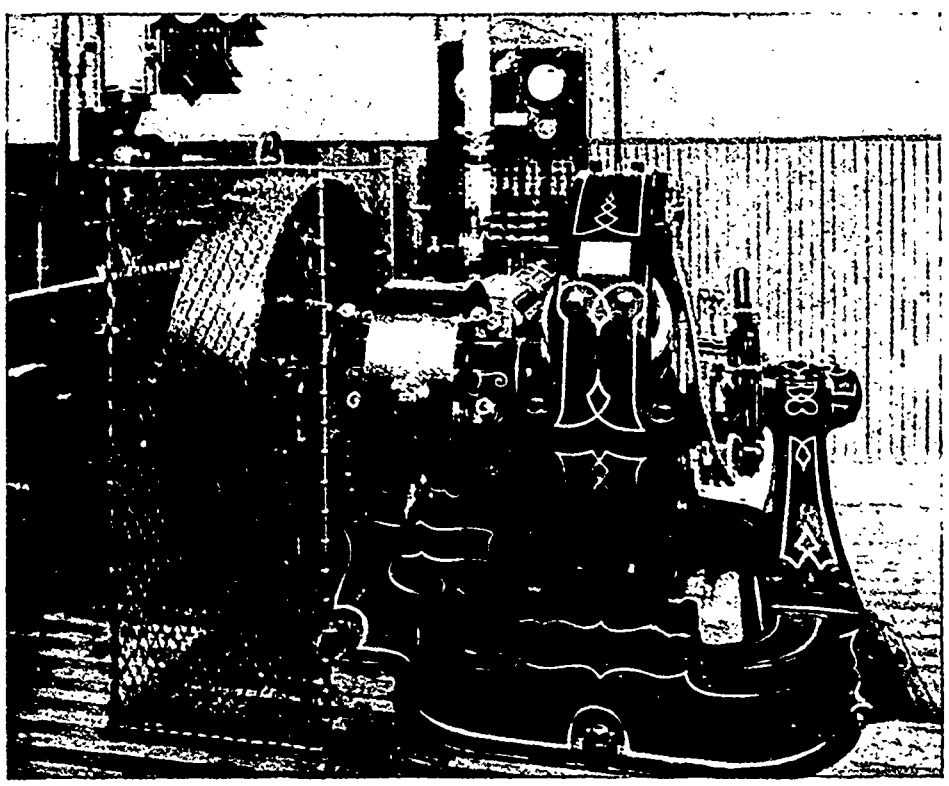
A noticeable feature of the switch is the use of miniature incandescent lamps as signals. There is one in front of each operator, which glows as long as a drop is down in front of her, requiring attention. The lamp not only serves to attract the attention of the answering operator, but also the supervising operator. The chief operator has also a bank of lamps in front of her on her desk, which are connected to the lamps in front of the operators, by means of which lamps the chief can see at a glance how promptly calls are being answered. Lamps are also used to show when inter-office trunk lines are out of use, a new and most desirable feature. The long distance lines come to a separate switch at one end of the room, and are attended to by special operators.

The board has an iron frame, with a covering of polished cherry, and everything about it, with the exception of the wires and cables, was made by the Northern Electric and Manufacturing Company, in Montreal. The board was set up by the Telephone Company's employees, the work of erection taking about eight months, while the actual time of transferring the 2,500 lines, the trunk lines and long-distance lines, was one hour and five minutes. This was successfully accomplished on August 14th.

Power for the self-restoring drops, transmitters, lamps, signals, etc., is obtained from 16 cells of storage batteries, for the charging of which two horse power motor generators are used. Two half horse power motor generators are used for ringing subscribers bells. An elaborate switchboard is used for controlling these various power circuits. The very best material and workmanship has been employed from start to finish, and the board is thoroughly complete and up-to-date, comparing favorably with any exchange in the world.

A COMPLETE ISOLATED PLANT.

The Canadian General Electric Company have recently installed for the O'Keefe Brewery Company, Limited, of Toronto, what is probably the completest isolated plant installed up to the present in any manufacturing establishment in the Dominion. The generator consists of a 25 kilowatt steel frame machine, direct-connected to an Ideal engine, running at 305 revolutions per minute. The design and construction of the apparatus are such as to secure the highest possible efficiency, combined with the greatest durability in service. The frame and pole pieces are cast from a specially selected soft steel of the highest magnetic permeability. The construction of the armature is such that currents of air circulate constantly through the core windings and commutator, ventilating them perfectly. The armature windings are straight copper bars, requiring but two joints for each convolution, rendering short circuits and similar troubles practically impossible, and facilitating any repairs which might become necessary on account of mechanical injury.



The O'Keefe Brewery Company's Plant.

The insulation of all the machines of this type is of the best, combining great mechanical strength and durability with high spark-resisting qualities. The increase in temperature up to full load is kept exceedingly low, and the use of carbon brushes insures absolute freedom from sparking under all conditions of load. Since starting up, this unit has shown itself to be entirely satisfactory, requiring practically no attention whatever.

The switchboard consists of a handsome dark marble panel, upon which are mounted the necessary switches and Weston instruments. A triple pole, double throw switch is used to connect the installation with the three-wire mains of the Toronto Electric Light Company, at such times as it is not desired to keep the plant in operation. The installation is one which reflects the highest credit upon the manufacturers, as well as being a source of satisfaction to the O'Keefe Company.

It might be added, that besides the lighting of the brewery, current is furnished to operate several small motors from which fans, ventilators, etc., are run throughout the buildings.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

EIGHTH ANNUAL CONVENTION.

BROCKVILLE was honored this year as the meeting place of the eighth annual convention of the Canadian Association of Stationary Engineers. The date, as fixed by the local association, was the 19th and 20th of August.

When the meeting was called to order at 9.30 a.m. of Thursday, there were in attendance the following executive officers: James Devlin, Kingston, president; E. J. Phillip, Toronto, vice-president; W. F. Chapman, Brockville, secretary; R. C. Pettigrew, Hamilton, treasurer; J. Murphy, Montreal, conductor; J. F. Cody, London, district deputy for Ontario; O. E. Granberg, Montreal, district deputy for Quebec. The officers of the Brockville association, nearly all of whom were present, are: A. Franklin, past-president; John Grundy, president; Charles Bertrand, 1st vice-president; F. B. Andrews, 2nd vice-president; W. Robinson, financial secretary; James Aikens, recording secretary; John McCaw, treasurer; Stanley Beaverstock, conductor; C. Mortimer, doorkeeper; Earnest Carr, E. Devine and James McRitchie, trustees.

MR. E. J. PHILLIP, President.

Delegates reported as follows:

Toronto No. 1 G. C. Mooring, James Huggett, Chas. Moseley, A. M. Wickens, W. G. Blackgrove, John Fox.

Montreal No. 1—Thos. Ryan, J. J. York, J. G. Robertson.

Hamilton No. 2—Robt. Pettigrew, Geo. Mackie.

Stratford No. 3—John Hoy.

Brantford No. 4—Thos. Pilgrim, A. Ames.

London No. 5 G. B. Risler, Wm. Gerry.

Ottawa No. 7—Thos. Wensley, T. G. Johnston.

Dresden No. 8 T. M. Steeper, Wm. Jameson.

Berlin No. 9—W. J. Rhodes, Jacob Heyd.

Kingston No. 10—C. Selby, F. Simmons.

Winnipeg No. 1 G. M. Hazlett, James Robertson.

Kincardine No. 12 Percy Walker, J. Ashton.

Wiarton No. 13—J. F. Cody, Ed. Dunham.

Peterboro' No. 14—Fred Donaldson, John Morency.

Brockville No. 15—F. P. Andrews, C. Wilkinson.

Carleton Place No. 16 Jos. McKay, W. J. Griffith.

Waterloo No. 17 Chas. Uttley, Fred A. Pflug.

Ald. F. G. McCrady, a member of the association, introduced Mayor Downey, who read an address of welcome. "When Watt made his immortal discovery of the steam engine," said the Mayor, "he little thought of the vast extent to which it would develop, or that the time would come when towns and cities would be dependent on the steam engine, not merely for the comforts, but also for the necessaries of life, and at times even for their very existence. *If we look at any of our* great factories, with hundreds of skilled operatives, guiding and directing machinery of many different kinds, which is driven by power derived from one central source, or at the waterworks or electric light system of a great city, we shall find the steam engine the source of all the power, controlled and regulated by a faithful and energetic man, on whose skill and integrity the successful operation of the whole elaborate system depended. It was important, therefore, that competent, trustworthy engineers be employed."

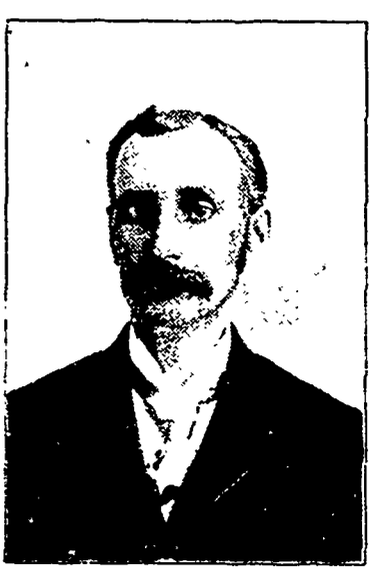
The president acknowledged the welcome extended to the engineers in a brief speech, and was followed by Aldermen McCrady, O'Brien, Wright and Buell, each extending the hand of friendship to the delegates. Mr. W. F. Chapman read an address of welcome from the local association, in which the advantages of the organization were pointed out.

PRESIDENT'S ADDRESS.

Mr. Devlin delivered the opening address as follows:

I have the honor to welcome you to this our eighth annual convention. I am aware that in selecting you as delegates our various branches have sent their best men, consequently I am confident that your deliberations will result in the advancement of our organization, and that in dealing with the various subjects brought before you, the one and only aim sought shall be the greater good of the C. A. S. E. I am sure that naught but good will shall prevail; indeed, such is one of the cardinal principles of our order. I need not ask for your hearty support, as this has always been given to the occupant of this chair.

The committee appointed to act jointly with the C. A. S. E. to draft a bill seeking from the Dominion Parliament a law compelling engineers to pass an examination and hold certificates of competency, met in Toronto on March 17th last. The result of the deliberations and a copy of the bill will be laid before you. As you are aware, the bill received two readings in the House of Commons, and I am assured by the delegates who had charge of the legislation at Ottawa that, were it not for the lateness of the session, there would have been every prospect of the bill becoming law. The thanks of the association are due to Mr. James Sutherland, M.P., for the kind reception of our delegates and for his earnestness in endeavoring to have the bill become law. In this connection I should say that in this movement not only are the members of our association a unit in favor of such a law, but, I might add, almost all the qualified engineers of this country are with us, as well as most of the manufacturers and steam-users.



MR. W. F. CHAPMAN, Vice President.

During the past year some of our branches which had for some years shown want of vitality have been resuscitated. They are now possessed of fair membership, active and diligent in the work of the order, educational and social. London particularly is doing good work. On the whole our membership, however, shows a slight increase this year over last year. Guelph and Stratford, I am sorry to say, are not in a prosperous condition, and some effort must be made to infuse new life into these tardy branches. During the past year I can only report the establishment of one new association, that at Waterloo, Ont. It is to be hoped that during the coming year more advancement will be made in this regard. However, whilst our membership may not have materially increased in numbers, there has been great care exercised in the selection of members, and the principles of the order have been most rigidly adhered to. I am most pleased to know that in some of the lodges the work is done with great precision, the use of the book of ritual being dispensed with by many of the presiding officers. The educational work, the great feature of the organization, goes on with greatly increased vigor and benefit to the members.

During the year I had the pleasure of attending meetings at our two great centres, Montreal and Toronto. In both I was struck with the material progress visible and the facilities available to members by way of books, models, etc., whereby the educational benefits, so invaluable and important, are advanced. This feature of our association's work cannot be too highly appreciated. It may be necessary at the present convention to again take up the matter of bi-annual conventions, with a view to the curtailment of the expense necessary for our annual meeting. Steps should also be taken to arouse the engineers of the Dominion to the loss they sustain in not being of our membership. The provision made at last year's convention for the issuing of certificates of member-

ship has been carried out. The matter of getting up a handbook souvenir from which we expected to derive sufficient funds to meet the expenses of the convention has not taken practical shape, consequently, for this year at least, our old sources of revenue will have to be relied upon.

Our worthy secretary and myself have been in correspondence for some time past, and he will lay before you very important information on the subject, which will be of great value when the postponed work is again taken up.

Difficulties and persecution which I encountered in common with others in the same employ have rendered it impossible for me during the past seven or eight months to give the active work to the accomplishment of the souvenir scheme which I had wished. Brethren, in conclusion, I desire to express to you my deep sense of gratitude for the great honor you conferred on me a year ago when you elected me to the high and honorable position of president of this association and for the loyal manner you have stood by me. In closing, I will only add it is my heartfelt wish that your deliberations at this meeting may be so conducted towards each other that everything we shall do will redound to the benefit and honor of our good association.

The following were appointed auditors: J. Robertson, Montreal; F. Donaldson, Ottawa; Geo. Mackie, Hamilton; F. P. Anderson, Brockville.

Standing committees were appointed as follows: Credentials, J. Huggett, C. Selby, C. Uttley; constitution and by-laws, J. J. York, G. B. Risler, A. M. Wickens; mileage, Jas. Robinson, G. C. Mooring, F. M. Steeper; good of order, F. Simmons, C. Moseley, H. McKay.

Adjournment was then announced until 1.50 p.m.

AFTERNOON SESSION.

Upon resuming business reports on finance, constitution, and by-laws and credentials were presented.

"The Stationary Engineers' Act," presented to the Dominion parliament at the last session, came up for discussion. Although unsuccessful in securing the passing of the bill, it was stated to be the intention to again take up the question, and a committee for that purpose was named. At three o'clock the delegates were furnished with cabs and driven around the town. A visit of inspection was made to the Asylum for the Insane, the electric light station and the fire hall.

In the evening another session was held. Mr. A. M. Wickens gave a short talk on the C. A. S. E., and was followed by Mr. E. J. Phillip, who read an interesting paper on "Condensors, and Re-cooling Injection or Circulating Waters." A lively discussion followed the reading of the paper. Mr. G. B. Risler, of London, then read a paper on "The Steam Engine Indicator," which is unavoidably crowded out of this number.

The question of holding semi-annually meetings, referred to in the report on the Good of the Order, was discussed, with the result that the proposition was voted down. The reports of the secretary and treasurer were presented and adopted. The receipts for the year were shown to be $431.25, and the disbursements $164.26, leaving a balance of $266.99. The question of publishing a souvenir was left in the hands of the secretary.

A contribution of $10 from the Royal Oil Company, of Kingston, was acknowledged, and the secretary was voted $25 for his services during the past year. At 10.30 adjournment was announced.

SECOND DAY.

The election of officers was the first business. The following was the result:

President E. J. Phillip, Toronto.
Vice-president W. F. Chapman, Brockville.
Secretary J. C. Robertson, Montreal.
Treasurer R. C. Pettigrew, Hamilton.
Conductor G. B. Risler, London.
Doorkeeper G. C. Mooring, Toronto.

Hamilton was decided upon as the next place of meeting.

Mayor Downey, on behalf of the association, presented the retiring president with a jewel. Mr. Devlin made a suitable reply.

Votes of thanks were tendered to the mayor and citizens of Brockville; to the retiring officers and the press.

In the afternoon the delegates were given a trip up the river as far as Alexandria Bay, by the kindness of Mr. W. H. Comstock, who placed his steam yacht, Albani, at their disposal. The outing was thoroughly enjoyed, an hour being spent at the bay. Upon returning at seven o'clock, a short closing session was held, at which the local association was tendered a vote of thanks for the arrangements made for entertaining the delegates. Special mention was made of Mr. R. A. Bush, chairman of the local committee.

THE BANQUET.

On Friday evening a banquet was tendered the visiting delegates by the local association at St. Lawrence Hall. Mr. Chapman presided, and besides a large number of engineers, there were also present prominent citizens, including ex-mayor Derbyshire, Town Clerk McMullen, and Mr. George Nicholson, of the James Smart Company. The menu was prepared to satisfy the most fastidious tastes, and was served in first-class style.

Following the usual attention given to the bill of fare came the toast list. The Queen was duly honored, and responses made to the various toasts by the persons named below: "Canada, our Home," by Rev. J. C. Sycamore, ex-Mayor Derbyshire and Town Clerk McMullen. "Brockville, The Island City," by Mayor Downey, Ald. McCrady and O'Brien. "The Manufacturers," by Messrs. Geo. Nicholson, of James Smart Mfg. Co., and T. G. Johnston, of Ottawa. "Kindred

MR. G. B. RISLER, Conductor.

Societies," by Messrs. F. Laurence, D. Reeves, W. J. Jento and A. M. Wickens. "The Executive," by Messrs. Devlin, Phillip, Pettigrew, Robertson, Risler and Mooring. The "C. A. S. E.," by Messrs. York, Blackgrove, Fitzsimmons, Andrews and Fox. "The Press," by representatives of the Times and Recorder and the Canadian Engineer. "The Local Association," by Mr. W. F. Chapman. "The Ladies," by Mr. Robertson, of Montreal, and "The Host and Hostess," by Mr. Horace Robinson.

Vocal music was furnished during the evening by Messrs. Blackgrove and Robertson, and recitations by Mr. Daly. Many of the delegates left for their homes on the midnight train, all pleased with the Brockville convention.

THE NEW OFFICERS.

Mr. E. J. Phillip, president-elect, is a gentleman of more than ordinary ability, and under his executive management the association may be expected to enjoy a year of marked advancement. He served his apprenticeship in Galt, removing to Toronto, where he was for two years engineer for the Toronto Incandescent Light Company. He is now chief engineer for the T. Eaton Company, having charge of one of the largest isolated plants in Canada.

In the first vice-president the association has an able officer. Mr. Chapman was born near Gananoque 37 years ago, has had considerable experience in setting up boilers and engines, and installed the electric light plant at Gananoque for the Electric Light and Water Supply Company. He now holds the position of en-

gineer for the Canada Carriage Company, Brockville. Through his efforts the local association was formed.

Treasurer Pettigrew, of Hamilton, is not an active engineer, although taking a deep interest in educational matters His energies are devoted to the coal and wood business, in which he has been quite successful.

Mr. G. B. Risler, conductor, and the author of the paper on "The Steam Engine Indicator," stands as an example of self-education. He was born in Zurich, Switzerland, in 1858, and at the age of 14 years was depending on his own resources. Having a liking for machinery, he followed the employment of fireman for a number of years, gradually working his way into the engine room. In 1884 he emigrated to Canada and served as engineer in a saw mill and woolen mill. In the year 1891 he was engaged by the Advertiser Printing Company, of London, and since that time has made great strides in educational work. Mr. Risler joined the C.A.S.E. in 1893, and last year was chosen president. He has received great benefit from the association, and vice versa. Although not yet fully master of the English language, by the assistance of the Correspondence School of Scranton he has become well posted in engineering matters, and always endeavors to combine theory with practice. He has collected a most valuable library of engineering works.

THE NATIONAL ELECTRICAL CODE.

(Concluded.)

CLASS D. FITTINGS, MATERIALS AND DETAILS OF CONSTRUCTION.

All Systems and Voltages.

40. WIRE INSULATION—

a. Rubber Covered—The insulating covering must be solid, at least three-sixty-fourths of an inch in thickness and covered with a substantial braid. It must not readily carry fire, must show an insulating resistance of one megohm per mile after two weeks submersion in water at seventy degrees Fahrenheit and three days submersion in lime water, and after three minutes' electrification with 550 volts. (See page 44.)

b. Weatherproof—The insulating covering must not support combustion, must resist abrasion, must be at least one-sixteenth of an inch in thickness, and thoroughly impregnated with a moisture repellent.

c. Flexible Cord—Must be made of two stranded conductors, each having a carrying capacity equivalent to not less than a No. 16 B. & S. wire, and each covered by an approved insulation, and protected by a slow-burning, tough-braid outer covering.

1. Insulation for pendants under this rule must be moisture and flame proof.

2. Insulation used for cords used for all other purposes, including portable lamps and motors, must be solid, at least one-thirty-second of an inch in thickness, and must show an insulation resistance between conductors, and between either conductor and the ground, of at least one megohm per mile after one week's submersion in water at seventy degrees Fahrenheit, and after three minutes' electrification, with 550 volts.

3. The flexible conductors for portable heating apparatus, such as irons, etc., must have an insulation that will not be injured by heat, such as asbestos, which must be protected from mechanical injury by an outer, substantial, braided covering, and so arranged that mechanical strain will not be borne by electrical connection.

d. Fixture Wire—Must have a solid insulation, with a slow-burning, tough, outer covering, the whole to be at least one-thirty-second of an inch in thickness, and show an insulation resistence between conductors, and between either conductor and the ground, of at least one megohm per mile, after one week's submersion in water at seventy degrees Fahrenheit, and after three minutes' electrification, with 550 volts.

e. Conduit Wire Must comply with the following specifications:

1. For insulated metal conduits single wires and twin conductors must comply with section (a) of this rule.

Concentric wire must have a braided covering between the outer conductor and the insulation of the inner conductor, and, in addition, must comply with section (a) of this rule.

2. For non-insulated metal conduits single wires and twin conductors must comply with section (a) of this rule, and, in addition, have a second outer fibrous covering, at least one-thirty-second of an inch in thickness, and sufficiently tenacious to withstand the abrasion of being hauled through the metal conduit.

Concentric conductors must have a braided covering between the outer conductor and the insulation of the inner conductor, and comply with section (a) of this rule, and, in addition, must have a second fibrous outer covering at least one-thirty-second of an inch in thickness, and sufficiently tenacious to withstand the abrasion of being hauled through the metal conduit.

41. INTERIOR CONDUITS—(For wiring rules, see Nos. 24 and 25.)

a. Each length of conduit, whether insulated or uninsulated, must have the maker's name or initials stamped in the metal, or attached thereto in a satisfactory manner, so that the inspectors can readily see the same.

Insulated Metal Conduits:

b. The metal covering, or pipe, must be at least equal in thickness, or of equal strength to resist penetration by nails, etc., as the ordinary commercial form of gas pipe of same size.

c. Must not be seriously affected externally by burning out a wire inside the tube when the iron pipe is connected to one side of the circuit.

d. Must have the insulating lining firmly secured to the pipe.

e. The insulating lining must not crack or break when a length of the conduit is uniformly bent at temperature of 212 degrees Fahrenheit to an angle of ninety degrees, with a curve having a radius of fifteen inches, for pipes of one inch and less, and fifteen times the diameter of pipe for larger pipes.

f. The insulating lining must not soften injuriously at a temperature below 212 degrees Fahrenheit, and must leave water in which it has been boiled practically neutral.

g. The insulating lining must be at least one-thirty-second of an inch in thickness, and the materials of which it is composed must be of such a nature as will not have a deteriorating effect on the insulation of the conductor, and be sufficiently tough and tenacious to withstand the abrasion test of drawing in and out of same long lengths of conductors.

h. The insulating lining must not be mechanically weak after three days' submersion in water, and, when removed from the pipe entire, must not absorb more than ten per cent. of its weight of water during 100 hours of submersion.

i. All elbows must be made for the purpose, and not bent from lengths of pipe. The radius of the curve in the inner edge of any elbow not to be less than three and one-half inches. Must have not more than the equivalent of four quarter bends from outlet to outlet, the bends at the outlets not being counted.

Uninsulated Metal Conduits:

j. Plain iron or steel pipes of equal thickness, or of equal strength, to resist penetration of nails, etc., as the ordinary commercial form of gas pipes of the same size, may be used as conduits, provided their interior surfaces are smooth and free from burs; pipe to be galvanized, or the interior surfaces coated or enamelled to prevent oxidization with some substance which will not soften so as to become sticky and prevent wire from being withdrawn from the pipe.

k. All elbows must be made for the purpose, and not bent from lengths of pipe. The radius of the curve of the inner edge of any elbow, not to be less than three and one-half inches. Must have not more than the equivalent of four quarter bends from outlet to outlet, the bends at the outlets not being counted.

42. WOODEN MOULDINGS—(For wiring rules, see No. 24.)

a. Must have, both outside and inside, at least two coats of waterproof paint, or be impregnated with a moisture repellent.

b. Must be made of two pieces, a backing and a capping so constructed as to thoroughly incase the wire, and provide a one-half inch tongue between the conductors, and a solid backing, which, under grooves, shall not be less than three-eighths of an inch in thickness, and must afford suitable protection from abrasion.

It is recommended that only hardwood moulding be used.

48 SWITCHES—(See Nos. 17 and 22.)

a. Must be mounted on non-combustible, non-absorptive, insulating bases, such as slate or porcelain.

b. Must have carrying capacity sufficient to prevent undue heating.

c. Must, when used for service switches, indicate, on inspection, whether the current be "on" or "off."

d. Must be plainly marked where it will always be visible, with the name of the maker and the current and voltage for which the switch is designed.

e. Must, for constant potential systems, operate successfully at fifty per cent. overload in amperes, with twenty-five per cent. excess voltage under the most severe conditions they are liable to meet with in practice.

f. Must, for constant potential systems, have a firm and secure contact; must make and break readily, and not stop when motion has once been imparted by the handle.

g. Must, for constant current systems, close the main circuit and disconnect the branch wires when turned "off"; must be so constructed that they shall be automatic in action, not stopping between points when started, and must prevent an arc between the points under all circumstances. They must indicate, upon inspection, whether the current be "on" or "off".

44. CUT-OUTS AND CIRCUIT BREAKERS (For installation rules, see Nos. 17 and 21.)

a. Must be supported on bases of non-combustible, non-absorptive insulating material.

b. Cut-outs must be provided with covers, when not arranged in approved cabinets, so as to obviate any danger of the melted fuse metal coming in contact with any substance which might be ignited thereby.

c. Cut-outs must operate successfully, under the most severe conditions they are liable to meet with in practice, on short circuits with fuses rated at 50 per cent. above and with a voltage 25 per cent. above the current and voltage for which they are designed.

d. Circuit-breakers must operate successfully, under the most severe conditions they are liable to meet with in practice, on short circuits when set at 50 per cent. above the current, and with a voltage 25 per cent. above that for which they are designed.

e. Must be plainly marked where it will always be visible, with the name of the maker, and current and voltage for which the device is designed.

45. FUSES—(For instalation rules, see Nos. 17 and 21.)

a. Must have contact surfaces or tips of harder metal having perfect electrical connection with the fusible part of the strip.

b. Must be stamped with about eighty per cent. of the maximum current they can carry indefinitely, thus allowing about 25 per cent. overload before fuse melts.

With naked open fuses, of ordinary shapes and not over 500 amperes capacity, the maximum current which will melt them in about five minutes may be safely taken as the melting point, as the fuse practically reaches its maximum temperature in this time. With larger fuses a longer time is necessary.

Inclosed fuses where the fuse is often in contact with substances having good conductivity to heat, and often of considerable volume, require a much longer time to reach a maximum temperature on account of the surrounding material which heats up slowly. This data is given to facilitate testing.

c. Fuse terminals must be stamped with the maker's name, initials, or some known trade mark.

46. CUT-OUT CABINETS

a. Must be so constructed, and cut-outs so arranged, as to obviate any danger of the melted fuse metal coming in contact with any substance which might be ignited thereby.

A suitable box can be made of marble, slate or wood, strongly put together, the door to close against a rabbet so as to be perfectly dust tight, and it should be hung on strong hinges and held closed by a strong hook or catch. If the box is wood the inside should be lined with sheets of asbestos board about one-sixteenth of an inch in thickness, neatly put on and firmly secured in place by shellac and tacks. The wires should enter through holes bushed with porcelain bushings; the bushings tightly fitting the holes in the box, and the wires tightly fitting the bushings (using tape to build up the wire, if necessary) so as to keep out the dust.

47. SOCKETS—(See No. 27.)

a. No portion of the lamp socket, or lamp base, exposed to contact with outside objects, must be allowed to come in electrical contact with either conductor.

b. Must, when provided with keys, comply with the requirements for switches. (See No. 43.)

48. HANGER-BOARDS—

a. Hanger-boards must be so constructed that all wires and current carrying devices thereon shall be exposed to view and thoroughly insulated by being mounted on a non-combustible, non-*absorptive insulating substance. All switches attached to the* same must be so constructed that they shall be automatic in their action, cutting off both poles to the lamp, not stopping between points when started and preventing an arc between points under all circumstances.

49. ARC LAMPS—(For installation rules, see No. 19.)

a. Must be provided with reliable stops to prevent carbons from falling out in case the clamps become loose.

b. Must be carefully insulated from the circuit in all their exposed parts.

c. Must, for constant current systems, be provided with an approved hand switch, also an automatic switch that will shunt the current around the carbons, should they fail to feed properly.

The hand switch to be approved, if placed anywhere except on the lamp itself, must comply with requirements for switches on hanger-boards, as laid down in Rule 48.

50. SPARK ARRESTERS—(See No. 19c.)

a. Spark arresters must so close the upper orifice of the globe that it will be impossible for any sparks thrown off by the carbons to escape.

51. INSULATING JOINTS—(See No. 26a.)

a. Must be entirely made of material that will resist the action of illuminating gases, and will not give way or soften under the heat of an ordinary gas flame or leak under a moderate pressure. They shall be so arranged that a deposit of moisture will not destroy the insulating effect, and shall have an insulating resistance of at least 250,000 ohms between the gas-pipe attachments, and be sufficiently strong to resist the strain they will be liable to be subjected to in being installed.

b. Insulating joints having soft rubber in their construction will not be approved.

52. *RESISTANCE BOXES AND EQUALIZERS—(For installation rules,* see No. 4.)

a. Must be equipped with metal, or with other non-combustible frames.

The word "frames" in this section relates to the entire case and surroundings of the rheostat, and not alone to the upholding supports.

53. REACTIVE COILS AND CONDENSERS—

a. Reactive coils must be made of non-combustible material, mounted on non-combustible bases and treated, in general, like sources of heat.

b. Condensers must be treated like apparatus operating with equivalent voltages and currents. They must have non-combustible cases and supports, and must be isolated from all combustible materials and, in general, treated like sources of heat.

54. *TRANSFORMERS—(For installation rules, see Nos. 11 and 33.)*

a. Must not be placed in any but metallic or other non-combustible cases.

55. LIGHTNING ARRESTERS—(For installation rules, see No. 5.)

a. Must be mounted on non-combustible bases, and must be so constructed as not to maintain an arc after the discharge has passed, and must have no moving parts.

CLASS E.—MISCELLANEOUS.

56. INSULATION RESISTANCE—

The wiring in any building must test free from grounds, i.e., the complete installation must have an insulation between conductors and between all conductors and the ground (not including attachments, sockets, receptacles, etc.) of not less than the following:

Up to	5	amperes	4,000,000
"	10	"	2,000,000
"	25	"	800,000
"	50	"	400,000
"	100	"	200,000
"	200	"	100,000
"	400	"	50,000
"	800	"	25,000
"	1,600	"	and over 12,500

All cut-outs and safety devices in place in the above.

Where lamp sockets, receptacles and electroliers, etc., are connected, one-half of the above will be required.

57. PROTECTION AGAINST FOREIGN CURRENTS—

a. Where telephone, telegraph or other wires, connected with outside circuits, are bunched together within any building, or where inside wires are laid in conduits or ducts with electric light or power wires, the covering of such wires must be fire-resisting, or else the wires must be enclosed in an air-tight tube or duct.

b. All aerial conductors and underground conductors, which are directly connected to aerial wires, connecting with telephone, telegraph, district messenger, burglar-alarm, watch-clock, electric-time and other similar instruments, must be provided near the point of entrance to the building with some approved protective device which will operate to shunt the instruments in case of a dangerous rise of potential, and will open the circuit and arrest any abnormal current flow. Any conductor normally forming an innocuous circuit may become a source of fire hazard if crossed with another conductor charged with a relatively high pressure.

Protectors must have a non-combustible insulating base, and the cover to be provided with a lock similar to the lock now placed on telephone apparatus or some equally secure fastening, and to be installed under the following requirements:

1. The protector to be located at the point where the wires enter the building, either immediately inside or outside of the same. If outside, the protector to be enclosed in a metallic, waterproof case.

2. If the protector is placed inside of building, the wires of the circuit from the support outside to the binding posts of the protector to be of such insulation as is approved for service wires of electric light and power (see No. 40a) and the holes through the outer wall to be protected by bushing the same as required for electric light and power service wires.

3. The wire from the point of entrance to the protector to be run in accordance with rules for high potential wires, i.e., free of contact with building and supported on non-combustible insulators.

4. The ground wire shall be insulated, not smaller than No. 16 B. & S. gauge copper wire. This ground wire shall be kept at least three inches from all conductors, and shall never be secured by uninsulated, double-pointed tacks, and must be run in as straight a line as possible to the ground connection.

5. The ground wire shall be attached to a water pipe, if possible, otherwise may be attached to a gas pipe. The ground wire shall be carried to, and attached to, the pipe outside of the first joint or coupling inside the foundation walls, and the connection shall be made by soldering, if possible. In the absence of other good ground, the ground shall be made by means of a metallic plate or a bunch of wires buried in a permanently moist earth.

58. ELECTRIC GAS LIGHTING—

Where electric gas lighting is to be used on the same fixture with the electric light:

a. No part of the gas piping or fixture shall be in electric connection with the gas lighting circuit.

b. The wires used with the fixtures must have a non-inflammable insulation, or, where concealed between the pipe and shell of the fixture, the insulation must be such as required for fixture wiring for the electric light.

c. The whole installation must be free from "grounds."

d. The two installations must test perfectly free from connection with each other.

59. SOLDERING FLUID—

a. The following formula for soldering fluid is suggested:

Saturated solution of zinc chloride	5 parts.
Alcohol	4 parts.
Glycerine	1 part.

CLASS F.—MARINE WORK.

60. GENERATORS—

a. Must be located in a dry place.

b. Must have their frames insulated from their bed-plates.

c. Must each be provided with a waterproof cover.

d. Must each be provided with a name-plate, giving the maker's name, the capacity in voltage and amperes and normal speed in revolutions per minute.

61. WIRES.

a. Must have an approved insulating covering.

The insulation for all conductors, except for portables, to be approved, must be at least one-eighth inch in thickness and be

covered with a substantial waterproof and flameproof braid. The physical characteristics shall not be affected by any change in temperature up to 200 degrees Fahrenheit. After two weeks' submersion in salt water at 70 degrees Fahrenheit it must show an insulation resistance of one megohm per mile after three minutes' electrification, with 550 volts.

b. Must have no single wire larger than No. 12 B. & S. Wires to be stranded when greater carrying capacity is required. No single solid wire smaller than No. 14 B. & S., except in fixture wiring, to be used.

Stranded wires must be soldered before being fastened under clamps or binding screws, and when they have a conductivity greater than No. 10 B. & S. copper wire, they must be soldered into lugs.

c. Must be supported in approved moulding, except at switchboards and portables.

Special permission may be given for deviation from this rule in dynamo rooms.

d. Must be bushed with hard rubber tubing one-eighth inch in thickness when passing through beams and non-water-tight bulkheads.

e. Must have when passing through water-tight bulkheads and through all decks, a metallic stuffing tube lined with hard rubber. In case of deck tubes they shall be boxed near deck to prevent mechanical injury.

f. Splices or taps in conductors must be avoided as far as possible. Where it is necessary to make them, they must be so spliced or joined as to be both mechanically and electrically secure without solder. They must then be soldered, to insure preservation, covered with an insulating compound equal to the insulation of a wire, and further protected by a waterproof tape. The joint must then be coated or painted with a waterproof compound.

62. PORTABLE CONDUCTORS—

a. Must be made of two stranded conductors, each having a carrying capacity equivalent to not less than No. 14 B. & S. wire, and each covered with an approved insulation and covering.

Where not exposed to moisture or severe mechanical injury, each stranded conductor must have a solid insulation at least one-thirty-second of an inch in thickness, and must show an insulation resistance between conductors, and between either conductor and the ground, of at least one megohm per mile after one week's submersion in water at seventy degrees Fahrenheit and after three minutes' electrification, with 500 volts, and be protected by a slow-burning, tough-braided outer covering.

Where exposed to moisture and mechanical injury as for use on decks, holds and fire-rooms—each stranded conductor shall have a solid insulation, to be approved, of at least one-thirty-second of an inch in thickness and protected by a tough braid. The two conductors shall then be stranded together, using a jute filling. The whole shall then covered with a layer of flax, either woven or braided, at least one-thirty-second of an inch in thickness, and treated with a non-inflammable, waterproof compound. After one week's submersion in water at seventy degrees Fahrenheit, with 550 volts and a three minutes' electrification, must show an insulation between the two conductors, or between either conductor and the ground, of one megohm per mile.

63. BELL OR OTHER WIRES—

a Shall never be run in same duct with lighting or power wires.

64. TABLE OF CAPACITY OF WIRES—

B. & S. G.	Area Actual C. M.	No. of Strands.	Size of Strands B. & S. G.	Amperes.
19	1,288	..	..	
18	1,624	..	..	3
17	2,048	..	..	
16	2,583	..	..	6
15	3,257	..	..	
14	4,107		..	12
13	6,530	..	..	17
..	9,019	7	19	21
	11,368	7	18	25
	14,336	7	17	30
	18,081	7	16	35
	20,709	7	15	40
	30,859	19	18	50
	38,9 2	19	17	60
	49,077	19	16	70
	60,088	37	18	85
	75,776	37	17	100
	97, 64	61	18	120
	121,928	61	17	145
	157,563	61	16	170
	198,977	61	15	200
	240,527	61	14	235
	296,387	91	15	70
	373 737	91	14	320
	413,639	127	15	340

When greater conducting area than that of 12 B. & S. G. is required, the conductor shall be stranded in a series of 7, 19, 37, 61, 91 or 107 wires, as may be required; the strand consisting of one central wire, the remainder laid around it concentrically, each layer to be twisted in the opposite direction from the preceding.

65. SWITCHBOARDS—

a. Must be made of non-combustile, non-absorptive, insulating material, such as marble or slate.

b. Must be kept free from moisture, and must be located so as to be accessible from all sides.

c. Must have a main switch, main cut-out and ammeter for each generator.

Must also have a voltmeter and ground detector.

d. Must have a cut-out and switch for each side of each circuit leading from board.

66. RESISTANCE BOXES.

a. Must be made of non-combustible material.

b. Must be located on switchboard or away from combustible material. When not placed on switchboard they must be mounted on non-inflammable, non-absorptive insulating material.

c. Must be so constructed as to allow sufficient ventilation for the uses to which they are put.

67. SWITCHES—

a. Must have non-combustible, non-absorptive, insulating bases.

b. Must operate successfully at fifty per cent. overload in amperes with twenty-five per cent. excess voltage under the most severe conditions they are liable to meet with in practice, and must be plainly marked where it will always be visible, with the name of the maker and the current and voltage for which the switch is designed.

c. Must be double-pole when circuits which they control supply more than six 16-candle-power lamps or their equivalent.

d. When exposed to dampness, they must be enclosed in a water-tight case.

68. CUT-OUTS—

a. Must have non-combustible, non-absorptive insulating bases.

b. Must operate successfully, under the most severe conditions they are liable to meet with in practice, on short circuit with fuse rated at fifty per cent. above, and with a voltage twenty-five per cent. above the current and voltage they are designed for, and must be plainly marked where they will always be visible with the name of the maker and current and voltage for which the device is designed.

c. Must be placed at every point where a change is made in the size of the wire (unless the cut-out in the larger wire will protect the smaller).

d. In places, such as upper decks, holds, cargo places and fire-rooms a water-tight and fireproof cut-out may be used, connecting directly to mains when such cut-out supplies not more than six 16-candle-power lamps or their equivalent.

e. When placed anywhere except on switchboards and certain places, as cargo spaces, holds, fire-rooms, etc., where it is impossible to run from centre of distribution, they shall be in a cabinet lined with fire-resisting materials.

f. Except for motors, search-lights and diving lamps shall be so placed that no group of lamps, requiring a current or more than six amperes, shall ultimately be dependent upon one cut-out.

A single-pole covered cut-out may be placed in the moulding when same contains conductors supplying current for not more than two 16-candle-power lamps or their equivalent.

69. FIXTURES—

a. Shall be mounted on blocks made from well seasoned lumber treated with two coats of white lead or shellac.

b. Where exposed to dampness, the lamp must be surrounded by a vaporproof globe.

c. Where exposed to mechanical injury, the lamp must be surrounded by a globe protected by a stout wire guard.

d. Shall be wired with same grade of insulation as portable conductors which are not exposed to moisture or mechanical injury.

70. SOCKETS—

a. No portion of the lamp socket or lamp base exposed to contact with outside object shall be allowed to come into electrical contact with either of the conductors.

71. WOODEN MOULDING—

a. Must be made of well seasoned lumber, and be treated inside and out with at least two coats of white lead or shellac.

b. Must be made of two pieces, a backing and a capping, so constructed as to thoroughly incase the wire and provide a one-half-inch tongue between the conductors, and a solid backing which, under grooves, shall not be less than three-eighths inch in thickness.

c. Where moulding is run over rivets, beams, etc., a backing strip must first be put up and the moulding screwed to this.

d. Capping must be secured by brass screws.

72. MOTORS—

a. Must be wired under the same precautions as with a current of same volume and potential for lighting. The motor and resistance box must be protected by a double-pole cut-out and controlled by a double-pole switch, except in cases where one-quarter horse-power or less is used.

The leads or branch circuits should be designed to carry a current at least fifty per cent. greater than that required by the rated capacity of the motor to provide for the inevitable overloading of the motor at times.

b. Must be thoroughly insulated. Where possible, should be set on base frames made from filled, hard, dry wood and raised above surrounding deck. On hoists and winches they shall be insulated from bed-plates by hard rubber, fibre or similar insulating material.

c. Shall be covered with a waterproof cover when not in use.

d. Must each be provided with a name-plate giving maker's name, the capacity in volts and amperes and the normal speed in revolutions per minute.

EDUCATIONAL DEPARTMENT

INTRODUCTORY

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

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

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

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

DECIMAL FRACTIONS.—Definitions and explanation of principles of, and method of reduction to common fractions, and vice versa.

SQUARE AND CIRCULAR MEASURE.—Definition and explanation and practical demonstrations of.

CUBICAL AND CYLINDRICAL MEASUREMENTS.—Definitions and explanations of, with practical hints.

SQUARE AND CUBE ROOT.—Definitions and explanations of.

SAFETY VALVE CALCULATIONS.—(Spring and Lever Types).—Principles of, with practical demonstrations.

BOILER CONSTRUCTION.—Stays, rivets, joints and seams, iron and steel plate strength of, with formula and practical demonstrations.

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

WM. THOMPSON.

[ARTICLE V.]

SAFETY VALVE CALCULATIONS.

All boilers should be fitted with two safety valves, one of which should be a lock-up valve, and set by the Boiler Inspector under whose immediate control it is.

The Canada Steamboat Act provides that every safety valve must have a lift equal to at least one-fourth of its diameter; the openings for the passage of steam to and from the valve must each have an area not less than the area of the valve, as must also all waste steam pipes, etc., and the area of a safety valve must equal one-half inch for each square foot of grate surface in or under the boiler.

LEVER TYPE.

Find the diameter of a safety valve required for a boiler whose grate bars are 5 feet long and furnace 3 feet wide.

We first find number of square feet of grate surface; then divide by 2, which gives area of valve in inches; square root of area divided by .7854 equals diameter,

$$\text{then } \frac{L \times W}{2} = A$$

$$\text{and } \sqrt{A} \div .7854 = D.$$

Where L equals length of grate bars,
W equals width of furnace,
A equals area of valve in inches,
D equals required diameter of valve.

$$\frac{5 \times 3}{2} = 7.5 \text{ sq. inches.}$$

$$7.5 \div .7854 = 9.549.$$

Square root of 9.549 equals 3.09 inches; then required diameter of valve is 3.09 inches, say 3⅛ inches.

Example (2): What weight is required to be placed 2 inches from the end of a safety valve lever to equal a boiler pressure of 50 pounds to the square inch, the diameter of valve being 3⅛ inches, the distance from fulcrum to valve 6 inches, and total length of lever from fulcrum 16 inches? The weight of valve and stem is 15 pounds, and effective moment of lever 80 inch pounds.

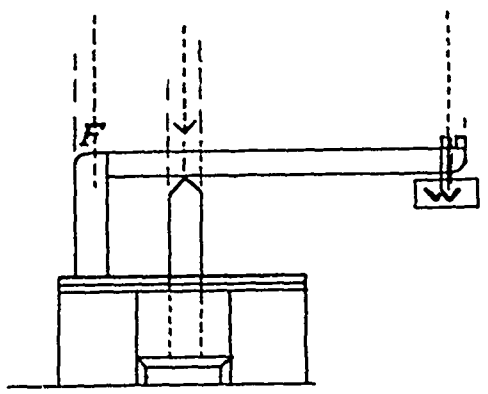


Fig. I

Since the steam pressure within the boiler and consequently pressing against the lower face of the valve and trying to unseat it, equals so many pounds per square inch, we must first find the area of the valve in square inches, to ascertain the whole force tending to raise the valve, but since the weight of the valve, spindle and lever acts downwards and against the upward pressure of the steam, we must make allowance for this, and the remaining force is that which we have to counteract by weight.

In diagram No. 1 F is the fulcrum, V is the point where pressure is exerted, W is the weight, FV is 6 inches, VW is 10 inches, and FW is 16 inches.

The principle of the lever is: The weight or force multiplied by its distance from the fulcrum is equal to the weight or pressure on the valve multiplied by its distance *from the fulcrum*,

$$\text{or, } W \times FW = V \times FV.$$

But the steam pressure has, in addition to the actual weight of W, also to overcome the moment of the lever, which is found by weighing the lever and finding how far its balancing point is from F; then this distance multiplied by its weight is the effective moment of the lever, which we will call A.

$$\text{Then } W \times FW + A = V \times FV;$$

that is, the total force at work keeping the valve down is equal to the force or pressure endeavoring to lift it off its seat.

In accordance, then, with these principles, we get the following rules:

(1) Find the area of the valve and multiply it by the pressure per square inch.

(2) From the product take the weight of the valve and stem; the remainder is the V of the formula.

(3) Multiply "the remainder by the distance from the fulcrum to the valve," FV, then subtract the moment of the lever, and divide by "the distance from the fulcrum to the weight," FW, found by adding "the distance from the fulcrum to the valve" to the "from the valve to the weight."

$3.125 \times 3.125 \times .7854 = 7.67$, area of valve.

$7.67 \times 50 = 383.50$, pressure against valve.

$383.5 - 15 = 368.5$, effective upward weight.

368.5×6 FV $= 2211.0$, effective moment *lifting* lever.

2211 − 80 (effective moment of lever acting downwards) = 2211 − 80 = 2131.

$2131 \div 16 = 133.2$, required weight of W.

NOTE: For extreme accuracy it is necessary to take note of the weight of the valve and its parts, and also of the moment of the lever; but in a great many cases this is entirely omitted. Then a question of this kind becomes simplified thus:

$$W = \frac{\text{area} \times \text{pressure} \times FV}{FW}$$

TO GRADUATE A SAFETY VALVE LEVER.

We have a safety valve 4 inches in diameter, and spindle presses against a point in the lever that is 4 inches *from the fulcrum*: how far must a weight of 120 pounds be placed from the fulcrum to equal a boiler pressure of 60 pounds to the square inch, when the valve weighs 8 pounds and effective moment of the lever is 5 inch pounds. Also give the graduation marks on the lever for 40 and 50 pounds pressure with the same weight.

Formula V = area × pressure − S.

$$FW = \frac{V \times FV - 50}{W}$$

In this question we require to find distance, FW. We first find area of valve; multiply this by pressure per square inch, and then subtract weight of valve and parts bearing downward to get the

effective upward pressure; this equals V of formula. Now multiply total upward pressure by distance fulcrum to valve and subtract effective moment of lever; result, divided by weight, equals distance fulcrum to weight.

4×4 16×.7854=12.5664, area valve.
12.5664 60=753.98, total pressure.
753.98 8=745.98, V, total effective pressure.
745.98×4=2983.92, total moment of valve.
2983.92 50=2933.92, total effective moment of valve.
2933.92 ÷ 120=24.45 inches distance FW.

Since the distance FW = 24.45 inches for a pressure of 60 pounds to the square inch, we can find what distance represents a pressure of 10 pounds by dividing this distance by 6, the number of times 10 is contained in 60.

$$24.45 \div 6 = 4.07.$$

Then for each additional 10 pounds pressure we require to move the weight a distance of 4.07 inches further from the fulcrum, and to find the distance from the fulcrum equal to a pressure of 40 pounds, this distance multiplied by 4 = FW; therefore,

FW at 50 pounds pressure = 4.07 × 5 = 20.35 ins.
FW at 40 pounds pressure = 4.07 × 4 = 16.28 ins.

Required to find distance from fulcrum to valve, boiler pressure being 50 pounds to square inch; diameter of valve, 4 inches; weight of valve and spindle, 10 pounds; distance valve to weight, 12 inches, and weight 150 pounds; moment of valve lever, 40 inch pounds.

Formula:

$$FV = \frac{VW \times W + \text{moment}}{V}$$

4² × .7854 12.5664 square inches.
12.5664 × 50 = 628.32, total pressure.
628.32 10 = 618.32, total effective upward pressure, or V.
12 × 150 = 1800 pounds.
1800 + 40 1840, total weight acting downwards at V.
1840 . 618.32 = 2.975 inches distance FV; or distance FV is nearly 3 inches.

SUMMARY.

TO FIND effective moment of lever, multiply weight of lever by distance from its balancing point or centre of gravity to fulcrum, and divide by distance from centre of valve stem to fulcrum. Result will be effective moment of lever in inch pounds, or the weight required to raise valve off its seat with nothing but lever holding against steam.

TO FIND actual effective weight of ball, divide weight of ball by distance from fulcrum to valve stem, and multiply quotient by distance from ball to fulcrum.

TO FIND length of lever, add together effective moment of lever and weight of valve and stem, and subtract from total pressure acting upwards against valve. Divide remainder by weight of ball, and multiply quotient by distance from stem to fulcrum.

TO FIND weight of ball, add together the effective moment of lever and weight of valve and stem, and subtract this sum from total pressure against valve at blowing-off point. Multiply remainder by distance from fulcrum to stem, and divide quotient by length of lever from fulcrum to weight.

TO FIND diameter of valve to blow off at given pressure, add together effective moment of lever, weight of valve and stem, and effective weight of ball. Divide this sum by gauge pressure, and result will be required area of valve.

Square root of area divided by .7854 equals diameter.

TO FIND pressure at which a boiler will blow off, add together effective moment of lever, weight of valve and stem, and effective weight of ball. Divide this sum by area of valve in square inches. Result will be gauge pressure at which safety valve will act.

FUNDAMENTAL PRINCIPLES OF ELECTRIC ENERGY.

COMMON UNITS OF MEASURE.

The units commonly met with by engineers in the study of the principles underlying the generation, transmission and use of electricity are the volt, ampere, ohm and watt.

In diagram No. 1 A is a dynamo or electric battery, and the source of electric energy, and the purpose of which is to produce a difference in potential between the terminals B and B_1. This difference in potential is measured in volts, and we say that between the terminals B and B_1 there exists an electric potential or pressure of so many volts, written symbolically (E.M.F.)

Let us now suppose that a difference in potential exists between B and B_1, and that B is the point of higher pressure; if we connect B and B_1 together by a substance capable of conducting electricity, there will be a flow from B to B_1. This flow of electricity is known as a current and measured as amperes.

The rate at which current will flow from B to B_1 when joined together by a conductor as at C depends upon following conditions: 1st, upon the difference in pressure or electric potential between B and B_1; 2nd, upon cross section or area of conductor

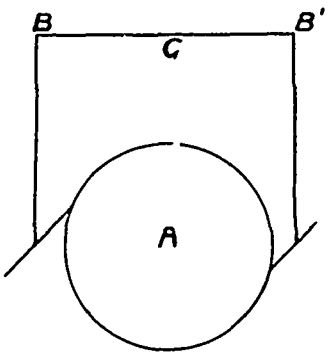


Fig. I

C, and upon length of C and nature of material of which C is composed; or, in other words, we may say that the rate at which current will flow through conductor C depends upon the difference in pressure and upon resistance offered by C to current.

Therefore, the greater the difference in potential the greater the current.

When a current flows through a conductor there is a loss in potential or voltage caused by the resistance of the conductor. This resistance is measured in ohms, and consequently a conductor is said to have a resistance of so many ohms.

When a difference in potential exists between B and B_1, but no connection between them, there is no flow of current through the dynamo or generator A, and therefore no work will be done by it. But if conductor C is connected to terminals B and B_1, current will at once begin to flow, and A will be compelled to do work to keep up the flow. The rate at which this work will be done will depend upon difference in potential between terminals B and B_1, and upon quantity of current flowing through the circuit. This then becomes the electrical energy or rate of doing work, and the electric unit of work or energy is the watt, and, in accordance with above, equals the volts multiplied by the amperes, or by the potential in volts multiplied by current in amperes.

The watt, then, is the product of one volt and one ampere, and in energy or work is equal to $\frac{1}{746}$ h.p., or 746 watts are equivalent to the mechanical force necessary to raise 550 pounds one foot high in one second, or 33,000 pounds one foot high in one minute.

The kilo-watt, as the name implies, equals 1,000 watts.

The symbols commonly used in formula to represent the units above described are as follows:

E. or E.M.F. equals electro motive force or volts.
C., the current or amperes.
R., the resistance or ohms.
W., or watts, represents the electrical energy.
K.W. represents kilo-watts.

(To be Continued.)

TRADE NOTES.

The Goldie & McCulloch Company, of Galt, have installed new engines for the Oshawa Malleable Iron Works Company.

The Canadian General Electric Company are installing an 150 light incandescent plant for the estate of Ross Bros., Buckingham, Que.

The New York offices of the Western Electric Company have been removed to their new building at 57 67 Bethune street. The retail store in the Thames street building is still retained.

The Rogers Electric Company, of London, Ont., are installing electric lights in the Anderson Furniture Company's factory, Woodstock, under sub-contract from the Stevens Manufacturing Company.

We are advised that the Montreal Street Railway Company, after a careful investigation of the merits of the various types of motors operated on their roads, have placed an order for fifty additional G.E. 1,000 motors with the Canadian General Electric Company.

The Toronto Electric Motor Company have recently placed a 600 incandescent light plant in the Methodist Book & Publishing Company's building, Toronto. The dynamo is direct connected with Ideal engine, manufactured by Goldie & McCulloch, of Galt.

The Ottawa Car Company have received an order from the Hamilton, Grimsby and Beamsville Railway Company for two cars of new design, to be 50 feet in length, with baggage and mail compartments. These are said to be the largest street railway cars yet manufactured in Canada.

The Canadian General Electric Company have received an order for a 2,000 light, single phase alternator for Revelstoke, B. C. This machine, which will be of their standard iron-clad revolving armature type, compounded to secure automatic regulation, will be used to supply incandescent lighting in Revelstoke and vicinity.

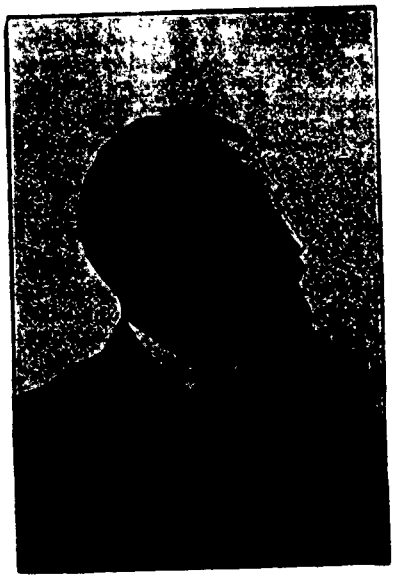
The Toronto Electrical Works has been reorganized and is now known as the Toronto Electrical Works Co., Limited. The company's offices and works have also been removed to commodious premises at 40 to 42 Adelaide Street West. Simultaneously with the above mentioned changes, the company have issued a new and comprehensive catalogue.

ELECTRIC RAILWAY DEPARTMENT.

AN ESTEEMED STREET RAILWAY MANAGER.

As a result of the control of the Birmingham street railway passing into the hands of Canadian capitalists, this country is to lose one of its most popular railway managers, in the person of Mr. Granville C. Cunningham, manager of the Montreal street railway. In company with Mr. Ross, Mr. Cunningham visited England recently, when the negotiations for securing the franchise of the Birmingham road were pending, and now comes the announcement that he has been appointed manager of the Birmingham system, while he is succeeded as manager of the Montreal road by Mr. F. L. Wanklyn, who recently took charge of the Toronto railway system.

Mr. Cunningham's removal to England is much regretted in street railway circles, not alone by his confr.res in other cities, but by the employees under him. As an evidence of this the employees of the Montreal



MR. GRANVILLE C. CUNNINGHAM.

street railway assembled at the Monument National Hall on the 20th ultimo. There were present Messrs. Duncan McDonald, superintendent; F. P. Brothers, superintendent of construction; J. S. Vindin, engineer; M. Watt, secretary; N. Graburn, assistant superintendent; L. Landers, cashier; T. Casey, storekeeper; A. Alexander, engineer of power house; W. G. Ross, controller; H. R. Lockhart, electrician; Dr. Mount, medical officer to the company; George Strubbe, claims agent; D. McQuaid, foreman carpenter; H. Taylor, mechanical superintendent, and probably 800 conductors, motormen and other employees. Mr. McDonald read the following address:

GRANVILLE C. CUNNINGHAM, ESQ:

DEAR SIR, -We, the officers and employees of the Montreal Street Railway Company, have, with feelings of deepest regret, heard the announcement of your resigning the management of the company, and feel that we cannot permit the occasion to pass without giving expression to the deep sense of the loss which we are about to sustain. In our past connection we have always experienced at your hands that just and fair treatment, patient consideration and courtesy which have won for you our esteem and regard, and made the severance of your connection with the company a personal loss to all of us.

While moved with feelings of regret that the relationship between us is about to cease, we cannot but feel gratified that you have been called upon to assume a charge of greater importance and responsibility, and in this and every future position that you may be called upon to fill, we offer to you our best wishes, and we pray that long life, health and happiness may be granted to both Mrs. Cunningham and yourself.

With this expression of our warmest feelings and regrets at your departure, we beg you to accept the accompanying remembrance.

Signed on behalf of the officers and employees of the Montreal Street Railway Company.

The address was accompanied by a magnificent silver tea and coffee set and a beautifully mounted cane, accompanied by an illuminated address, which was framed and contained the portrait of the recipient.

Mr. Cunningham, in replying, said the ovation was as unexpected as it was complimentary, and he thanked them all from the bottom of his heart. He referred to the reputation which the employees of the Montreal street railway enjoyed. It was only the other day, he said, that a gentleman from England had referred to the excessive kindness and politeness of the officials to the travelling public.

ROLLER BEARINGS FOR ELECTRIC TRACTION.

"ROLLER BEARINGS" was the title of a paper read before the British Association for the Advancement of Science at its recent convention in Toronto, by Mr. W. Bayley Marshall, M. Inst. C. E. The paper strongly advocated the employment of roller bearings for electric railways, and contained points of interest to railway people. Among the chief advantages claimed for these bearings by Mr. Marshall are great reduction in starting effort, decreased traction and revolving effort, and economy in lubrication.

Concerning their adaptability for electric traction he says: "In the case of electrical traction the reduced starting effort is of almost vital importance, as not only does it effect a very considerable saving in electrical output, but also greatly reduces the serious rush of current through the motors at the moment of starting, which rush is due to the fact that the motors and load have to be started at the same moment, with results most detrimental to the life of the motor. If the necessary effort can be materially reduced, there will be a large economy effected under the head of "Maintenance of Motors." The Liverpool overhead railway made their first trials with these roller bearings some two years ago, and are now gradually fitting them to the whole of their rolling stock, as they find that since their introduction they have, with a slight modification of their motors, been enabled to run three instead of two coach trains, the extra coach being without motors, thus increasing the carrying capacity of their trains by 50 per cent. The contention that the application of roller bearings in the case of electrical traction will show a great economy under the head of "Maintenance of Motors" has been amply borne out by the experience gained at Liverpool."

In describing the patent for roller bearings taken out

by Mr. Frederick Purdon, Mr. Marshall says: "The invention has developed into its present form by the following steps:—As first designed the bearing rollers were spaced by balls placed between each pair of rollers, two sets of balls being provided, one at each end. It was found that these balls had not sufficient controlling power to prevent the rollers from cross-winding. The next step was to substitute subsidiary rollers for the balls, and a theoretically perfect bearing was produced, its only fault being that it is too costly and complicated to allow of its application, except under special circumstances. The final step was the introduction of the floating stage, which, though not so theoretically perfect, has been found to give even better results in practice than the subsidiary roller design, and has the merit of great simplicity."

SPARKS.

The London street railway is now being extended to Pottersburg.

A project is said to be on foot to construct an electric street railway from Sarnia to Weisbeach.

A conductor on the Kingston street railway confessed to having been tapping the fare boxes for some time.

The Yarmouth Street Railway Company have purchased a 45 kilowatt generator from the Canadian General Electric Company.

It is probable that the Montreal Park & Island railway will be extended to L'Assomption. Steps looking to that end have already been taken.

The Toronto Street Railway Company are erecting a new three-storey brick office building at the north-west corner of King and Church streets.

Mr. Wm. Mackenzie, president of the Toronto Railway Company, has stated that Sunday cars in Toronto are a success from a financial standpoint.

The annual meeting of the shareholders of the Montreal Park & Island Railway Company will be held at the company's offices in Montreal on the 16th inst.

An American syndicate is said to be considering the construction of an electric street railway on Wells' Island, near Kingston, connecting Thousand Island Park, Fine View and Westminster Park. The distance is about seven miles.

The Chatham City & Suburban Railway Company, of which Mr. George C. Rankin is the chief promoter, desires power to extend its line north from the city, through the township of Dover to Mitchell's Bay, thence to Wallaceburg and Petrolea.

A special general meeting of the shareholders of the Winnipeg Electric Street Railway Company will be held in the city of Montreal on the 16th inst., to consider the offer made by the Manitoba Electric & Gas Light Company for the sale to the said railway company of their assets and plant.

The Lord's Day Alliance are opposing the running of street cars in Hamilton on Sunday, and have requested the Ontario government to carry the case to the Privy Council. The trial judge and the Court of Appeal dismissed the case against the company, adding that it could run cars on Sunday. It is improbable that the Ontario government will take any action in the matter.

The Aylmer Electric Light and Manufacturing Company, Aylmer, Ont., are installing an extensive incandescent lighting system. They have awarded the contract for the apparatus required for the plant to the Canadian General Electric Company. The generator will consist of a 60 kilowatt 1000 light standard single-phase alternator of the revolving iron-clad armature type, compounded to secure automatic regulation.

An interesting paper was read at the recent convention of the British Association for the Advancement of Science, by Mr. J. G. Waldridge, the title being, "The Present Tendency of Electric Tramway Traction." Mr. Waldridge stated that the United Kingdom had practically 130 miles of electric tramway; of this length, 103½ miles are operated on the trolley or overhead wiresy stem, 15¾ miles by means of a third rail conductor, 6 miles by storage batteries, and only 4 miles on the underground conduit system. These proportions, he thought, could be taken as fairly representative of other countries also. The tendency in Great Britain was in favor of the overhead wire system, the objections to which, in the past, had been entirely æsthetic. This system appeared likely to come into still greater use than has already been the case, if only on the ground of economy. The ordinary underground conduit, with open slot, was most expensive to install and troublesome to maintain efficiency, the cost of construction sometimes reaching £12,000 per mile. Closed conduits with surface contacts usually operated by means of electro-magnetic switching devices in boxes under the street level are complicated, and it is to be feared are unreliable. The great weight of lead required on each car for accumulator traction means practically that the live paying load can never reach 25 per cent. of the gross weight of loaded car; whilst the combination of trolley wire and battery, attempted on systems like those of Hanover and Dresden, are obviously ill-designed, the dead weight of battery being carried throughout the entire journey, though it is only required for part thereof.

MOONLIGHT SCHEDULE FOR SEPTEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	P. M. 7.50	A. M. 4.40	8.50
2.....	" 8.10	" 4.40	8.30
3.....	" 8.40	" 4.40	8.00
4.....	" 9.20	" 4.40	7.20
5.....	" 10.00	" 4.40	6.40
6.....	" 10.40	" 4.40	6.00
7.....	" 11.30	" 4.40	5.10
8	.....	" 4.40	4.40
9.....	A.M. 12.00	.....	
10.....	" 12.50	" 4.40	3.50
11.....	" 2.20	" 4.40	2.20
12.....	No light.	No light.	....
13.....	No light.	No light.	....
14.....	No light.	No light.	....
15.....	P. M. 7.00	P. M. 9.00	2.00
16.....	" 7.00	" 9.20	2.20
17.....	" 7.00	" 10.00	3.00
18.....	" 7.00	" 10.30	3.30
19.....	" 7.00	" 11.00	4.00
20	" 7.00	" 11.40	4.40
21.....	" 7.00	A. M. 12.30	5.30
22.....	" 7.00	" 1.10	6.10
23.....	" 7.00	" 2.10	7.10
24.....	" 7.00	" 3.20	8.20
25	" 7.00	" 4.30	9.30
26.....	" 6.40	" 4.50	10.10
27.....	" 6.40	" 4.50	10.10
28.....	" 6.40	" 4.50	10.10
29.....	" 6.40	" 4.50	10.10
30	" 6.40	" 4.50	10.10
.....	"	.....	....
		Total,	168.20

MOONLIGHT SCHEDULE FOR OCTOBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	P. M. 7.40	A. M. 5.00	9.20
2.....	" 7.40	" 5.00	9 20
3.....	" 7.40	" 5.00	9.20
4.....	" 11.20	" 5.00	5.40
5.....	.....	" 5.00	4.30
6.....	A.M. 12.30	.....	
7.....	" 1.50	A.M 5.10	3.20
8.....	" 3.00	" 5.10	2.10
9.....	No light.	No light.	....
10.....	No light.	No light.	....
11.....	No light.	No light.	....
12.....	No light.	No light.	....
13.....	P. M. 6.00	P. M. 8.20	2.30
14.....	" 6.00	" 8.20	2.30
15.....	" 5.50	" 9.00	3.10
16.....	" 5.50	" 9.50	4.00
17	" 5.50	" 10.50	5.00
18.....	" 5.50	" 11.50	6.00
19.....	" 5.40	A. M. 12.50	7.10
20.....	" 5.40	" 2.00	8.20
21.....	" 5.40	" 3.20	9.40
22.....	" 5.40	" 4.30	10.50
23.....	" 5 40	" 5.20	11.40
24.....	" 5.40	" 5.20	11.40
25.....	" 5.40	" 5.20	11.40
26.....	" 5.40	" 5.20	11.40
27	" 5.50	" 5.20	11.30
28.....	" 6.00	" 5.20	11.20
29.....	" 6.50	" 5.30	10.40
30.....	" 7.50	" 5.30	9.40
31.....	" 7.50	" 5.30	9.40
		Total,	202.20

SPARKS.

The ratepayers of Vernon, B. C., have sanctioned a by-law to borrow $12,000 for an electric light plant.

The village of Grand Forks, B. C., has decided to borrow funds for the purchase of an electric light plant.

The Canadian General Electric Company are installing an incandescent lighting machine for the Toronto Paper Company at the Cornwall mills.

Messrs. I. Matheson & Co., Limited, of New Glasgow, N. S., have purchased an incandescent lighting generator from the Canadian General Electric Company.

It is reported that the Quebec government will shortly offer for sale the water power of the Shawenegan Falls, on the St. Maurice river, at an upset price of $50,000.

The Electrical Power and Manufacturing Company, of Hamilton, have requested permission from the city to supply light and power. The capital stock is $20,000.

The British Columbia Mills, Timber and Trading Co., of Vancouver, B. C., are lighting up their mills by electricity, the plant being furnished by the Royal Electric Co., Montreal.

It is learned that the Canadian General Electric Company are constructing a 75 kilowatt steel frame, direct connected, direct current generator for McGill University, Montreal.

The Canadian Pacific Railway Co. have recently largely increased the staff in their car shops at Perth, and are working overtime. The Royal Electric Co. is installing a plant in their shops.

Messrs. Champoux & Brother, D'Israeli, P. Q., are installing a 650 light alternating current dynamo, which they purchased from the Royal Electric Co. They are lighting the town and their mills.

In Germany the horse is being supplanted by electric power in ploughing. Engineering gives illustrations and description of machines constructed by A. Borsig, of Berlin, and used in the sugar plantations in that country with success.

As a result of the decision of the courts that the poles, wires, etc., of the Toronto Street Railway Company are assessable, the assessment commissioner of London has decided to assess similar plant owned by the street railway company in that city.

The Hamilton, Grimsby and Beamsville Railway Company were replacing the girder rails with T rails through the village of Stoney Creek, when the residents objected. Some of them are charged with turning the hose on the president and manager.

Incorporation has been granted to the Ballard Electric & Machine Co., Limited, with a capital of $24,000, and head office in Toronto. The promoters are: P. E. Doolittle, Coventry, England; J. O. G. Ballard, G. L. Ballard, S. E. Ballard and H. T. Ballard, all of Toronto.

A company has been formed at Strathroy, Ont., composed of Messrs. H. McCall, John C. Scott, A. Reed, F. N. Saylor and G. M. Haldane, to extend the electric lighting business. It is the intention to enlarge the present building and install considerable new plant, including a generator.

The Exeter Light & Power Company, recently organized to take over the lighting business in Exeter formerly operated on a small scale by Captain Howard, have placed an order with the Canadian General Electric Company for a 1,000 light single-phase alternator, of their standard iron-clad armature compound-wound type.

The Canadian General Electric Company are installing a 75 kilowatt monocyclic generator for Messrs. Kilmer, Cowan & Co., of Southampton. This machine, which will be operated from a water-power, conveniently located, will supply current for incandescent lighting and power for the two neighboring towns of Southampton and Port Elgin.

Mr. E. F. Sheppard, in his report to the Department of Trade and Commerce on the possibilities of trade with Mexico, says: "The principal houses for telephone, telegraphic and electric light supplies of the United States are represented, and not only take large orders, but carry a more or less complete stock of general supplies. The business is developing into large proportions. To do business an agent and stock would be required at the capital."

Mr. Taylor, of the Taylor Hydraulic Company, Montreal, is at present in British Columbia, where a company has been formed, with a capital of $1,000 000. It is expected that the hydraulic air compression system for the transmission of power will be brought into requisition in developing many of the mining properties on the coast. A plant is now being installed at the Ainsworth camp, the intention being to distribute the power over a radius of six miles.

The Kingsville Electric Light Co., a corporation recently organized in that town, have decided to light the town, stores and residences by electricity, displacing natural gas, and for this purpose have bought from the Royal Electric Co. an "S.K.C." 500 light two-phase generator, with the necessary transformers and material requisite to wire up 500 lights, which is the amount they intend to start work with. The Kingsville Electric Co. have made a contract by which they use natural gas for fuel. They intend to furnish incandescent and arc lights as well as motors.

The Berlin Gas Co., of Berlin, have been operating an incandescent lighting plant on the three wire system, but are now extending the incandescent lighting service so as to furnish light to the residential portion of the town. They have decided to use an alternating current and have placed the order for the new equipment with the Royal Electric Co., using the "S.K.C." system throughout. They have just made extensive alterations in their station, and have now 2 100 k.w. Edison 500 volt generators for furnishing current to the Berlin & Waterloo Street Railway. They also operate a local power service from their three wire low tension system, besides furnishing the town with arc lamps, for which purpose they operate 2 50 light 4 amp. Ball dynamos.

The new electric locomotive recently shipped from the works of the Canadian General Electric Company to the Hull Electric Company, is by long odds the largest machine of the kind so far constructed in Canada. The motive power will be furnished by a four motor equipment of G.E. 51 motors, having at normal current input a capacity of 80 horse power each. The trucks are of the Maguire "L" pattern, with steel rim wheels. The body, which differs in operation and detail from the first locomotive supplied to the Hull Electric Company, was built for the Canadian General Electric Company by the Crossen Car Company, of Cobourg. We expect to furnish in our next issue complete detailed description of this interesting piece of apparatus, especially important as the fore-runner of many similar machines to be built for future heavy electric traction in the Dominion.

The Penman Manufacturing Co., of Paris, Ont., who operate some of the largest cotton mills in Canada, have made a number of improvements and additions to their mills in Paris, and among the improvements have decided to light the mill by electricity. The contract for a 500 light "S.K.C." machine and the wiring of the factories has been awarded to the Royal Electric Company, who purpose using for this their "S.K.C." two-phase alternating current apparatus, the dynamo wound to deliver to the mains current at a pressure that can be used directly in the lamps, from 100 to 115 volts. This is the first instance in Canada where alternating current is used for factory lighting, and the "S.K.C." is as far as we know the only machine that is interchangeable and can be used from 100 to 2000 volts with the same armature winding, the only thing necessary to change the voltage being to change the connections. It has been held heretofore by electrical manufacturers that it was not practical to use alternating current for factory lighting. This has been opposed for some time by the more advanced of dynamo builders, and in a short time we will have demonstrated the feasibility of the alternating current for this purpose.

PERSONAL.

Mr. J. W. Moyes, manager of the Metropolitan Street Railway, has been unanimously chosen by the Conservatives of East York as candidate for the local legislature.

It is reported that Mr. Duncan McDonald, Superintendent of the Montreal Street Railway, will shortly assume the duties of general manager of the Toronto Street Railway.

Mr. J. Alexander Culverwell, formerly connected with the Canadian General Electric Company, has been appointed local manager for Central Ontario of the London and Lancashire Insurance Company.

Mr. Wm. Barron, manager of the Brantford Electric Railway Company, was, in St. Basils church in that city, united in marriage to Miss Emily Blanche. The ELECTRICAL NEWS extends congratulations.

Mr. W. H. Woodward, a noted English electrician of Wolverhampton, and who is said to be the proprietor of the largest electrical works in Great Britain, was a visitor in Toronto during the recent convention of the British Association for the Advancement of Science.

CANADIAN GENERAL ELECTRIC CO.

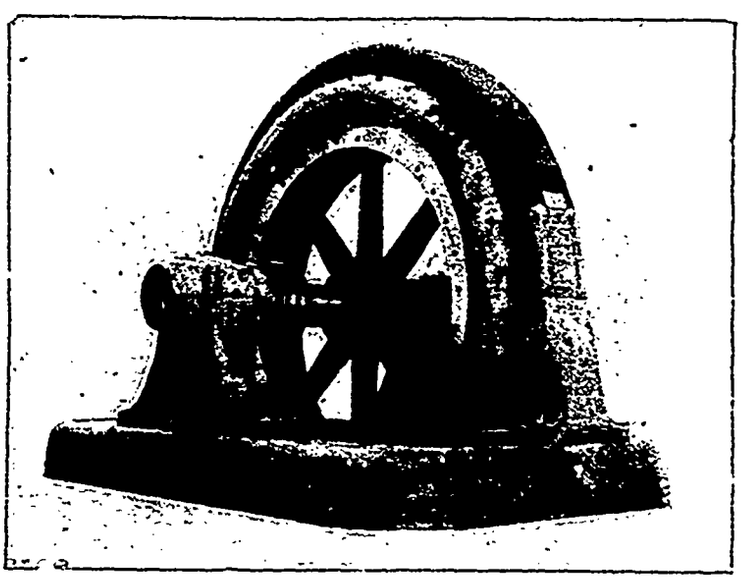
(LIMITED)

HEAD OFFICE: 65 FRONT STREET WEST, TORONTO, ONT.

BRANCH OFFICES AND WARE-ROOMS:

1802 Notre Dame St. - MONTREAL. || Main Street - - WINNIPEG.
138 Hollis Street - HALIFAX. || Granville Street - - VANCOUVER.

NELSON, B. C.



C. G. E. ALTERNATING GENERATOR, REVOLVING FIELD TYPE.

THE WEST KOOTENAY POWER & LIGHT CO., LIMITED,

have just commenced work on the most important power transmission plant so far undertaken in Canada outside of the immediate neighborhood of the city of Montreal. The distance of transmission is thirty miles, the line potential 20,000 volts, and the amount of power to be developed 8,000 horse power. For this important work the three-phase system of the Canadian General Electric Company has been selected and a contract awarded for the initial installation of 2,000 horse-power. The generators will be of the revolving field type, and of 1,000 h.p. capacity each. In type they will be generally similar to the twelve 1,000 h.p. units now being installed for the Lachine Rapids Hydraulic & Land Co.

SPARKS.

The management of the Royal Electric Co. have declared a quarterly dividend of 2 per cent., payable October 1st.

The Ottawa Street Railway Company have recently placed another dynamo in their power house at the Chaudiere, thus making five machines.

The Citizens' Electric Light Co., of Watford, Ont., have their plant in operation. The alternating system is used, the plant having a capacity of eight hundred 16 candle power lights.

The steamer "Esturion," of Lindsay, has recently been fitted with an electric light plant by Mr. Bruce McBurney. The system comprises 21 incandescent lights of 16 candle power, and a 2000 candle power search light.

Mr. E. A. Wills, secretary of the Toronto Board of Trade, has received a letter from a correspondent in Alexandria, Egypt, in which it is pointed out that among other Canadian goods a market for belting and electrical supplies could be found in that country.

Incorporation has been granted to the Alaska Telegraph & Telephone Company, to build a telegraph line from Dyea to Dawson City, Alaska, with a branch to Junea. A cable, containing both telegraph and telephone lines, will be laid, which will rest on the surface of the ground, no poles being used. The company is capitalized at $250,000, and the directors are C. W. Wright, Theodore Richard, D. E. Bohenan, J. W. Wright and J. F. Fassett.

The city council of Halifax, N. S., have now under consideration the question of street lighting, and will probably purchase an electric light plant to be operated by the city. An estimate of the cost of a suitable plant has been prepared by Mr. Colpitt, electrician, who states that an arc plant would cost about $43,000 for 250 lights, and for 1,500 incandescent lights the cost of a plant would be $6,000. The engineer has been asked to furnish a report regarding the available water power.