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OLD SERIES, VOL. XV.—No. 6
NEW SERIES, VOL. V.—No. 3.

MARCH, 1895

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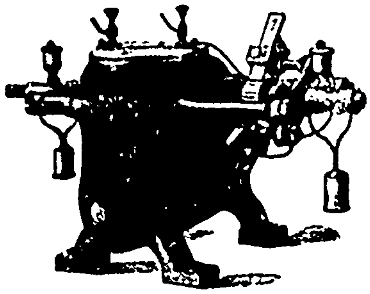

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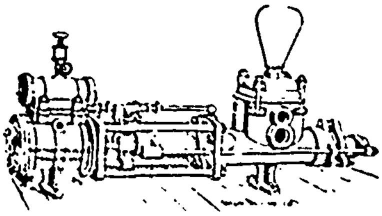

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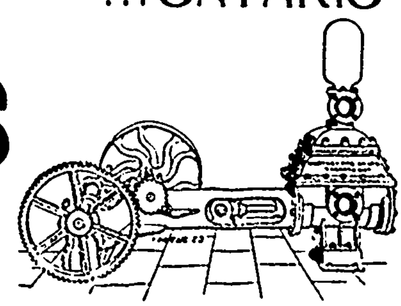

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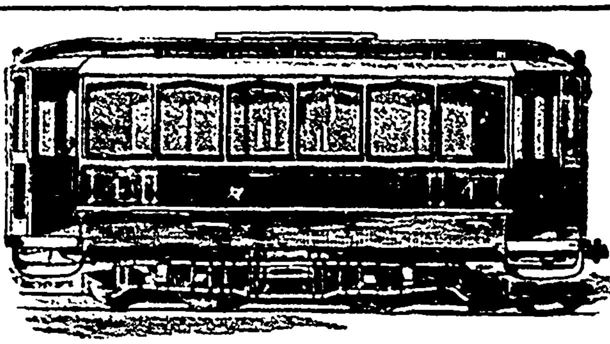

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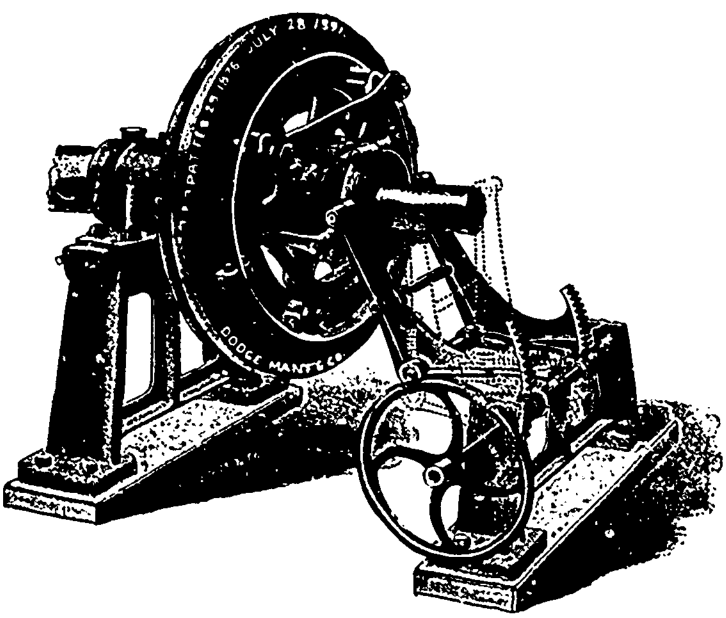
STEAM ENGINEERING JOURNAL.

VOL. V. MARCH, 1895 No. 3.

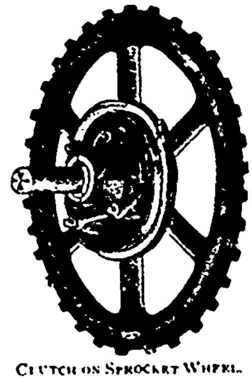
THE DODGE PATENT SPLIT FRICTION CLUTCH AND CUT-OFF COUPLING.

THE utility of friction clutch pulleys for power transmission has been fully demonstrated by long and continuous service, and their advantages over the belt destroying shifter are so numerous and obvious that one wonders why their already extensive use is not universal. Even in the matter of first cost the clutch equipment is not greatly in excess of that of tight and loose pulleys, when the extra pulleys and double widths necessary for the drivers are considered. By placing the clutch pulley upon the driving shaft, the belts and all the auxiliary shafting connected or controlled by the clutch are thrown out of action, saving belting, power, oil and danger from hot bearings and pulleys. Amongst the comparatively new clutches on the market is the Dodge Split Clutch, manufactured by the Dodge Wood Split Pulley Company. This clutch is made for service as a cut-off coupling, or may be used in connection with pulleys, gears, sprockets, rope sheaves, friction or hoisting drums, and various other power connections. Its simplicity is readily appreciated by mechanics who have ever had any experience with clutches of more or less complicated mechanism and those having a large number and variety of parts.



DODGE CLUTCH WITH SHIFTER.

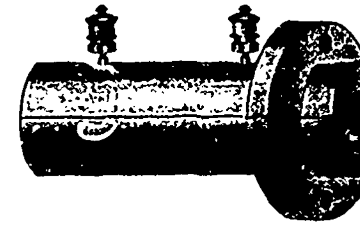
The friction disc is made of iron with perforations therein, through which hardwood friction blocks are fastened, presenting two surfaces of end grain for frictional contact. This disc is a part of the extended sleeve or portion of the clutch connected to the pulley, or whatever driving appliances may be used, and runs loose on the shaft where the clutch is located at the driven end of the transmission. The friction connection is made through two finished cast iron plates, one of which is keyed to the shaft, and which are thrown in contact with the wood filled disc by throwing in a sliding collar which works loose on the shaft, through the thrust of the collar actuating the toggle levers which operate four draw-bolts, forcing the friction plates to contact with the friction disc—this connection operating the pulley or transmission wheel in conformity with the moving shaft. One of the main difficulties existing in the various styles of clutches is the lack of clearance between the friction disc and plates, this trouble is entirely obviated in the Dodge clutch, the clearance being large and instantaneous, actuated by powerful coil springs which separate the plates quickly upon a withdrawal movement on the sliding collar. Two levers are used with four points of contact on the plates, there being no loose or rattling joints; the levers are made solid in one piece and have carefully finished fulcrum points on the outer or loose friction plate.



CLUTCH ON SPROCKET WHEEL.

The Dodge Wood Split Pulley Co., appreciating the trade demand for a simple, quick acting clutch, with all possible points of advantage considered, have incorporated the split or separable feature as being one of the most important and quickest of appreciation by consumers. The advantages in a split clutch are manifold, they are easier and quicker to *adjust to shaft or repair*, and effect quite a saving in time and labor. None of the shafting or other equipment need be disturbed in placing the clutch in position. When this point is fully understood and appreciated we bespeak a more rapid change from the old tight and loose pulley ideas to the modern plan of machine driving. It is the expense of the split clutch as formerly made, as well as the trouble and expense involved in putting on solid clutches that has kept many manufacturers from making the changes long ago. This clutch is put on the market at about the same price as any other first-class clutch, but having the split feature to its credit. The Dodge split clutch is particularly adapted to service with gears, sprockets and other connections, and the only necessary features of these appliances over the regular goods is the large bore necessary to fit the extended sleeve. This sleeve is separate from the friction disc and may be easily detached for repairs without handling any portion of the clutch mechanism. For ordinary service the sleeve is lined with genuine babbit and fitted with compression grease cups to insure continuous efficient lubrication The pulley is clamped ove the sleeve and keyed securely. An improvement of very great practical importance is the patented separable or detachable hub, which bears to the clutch the

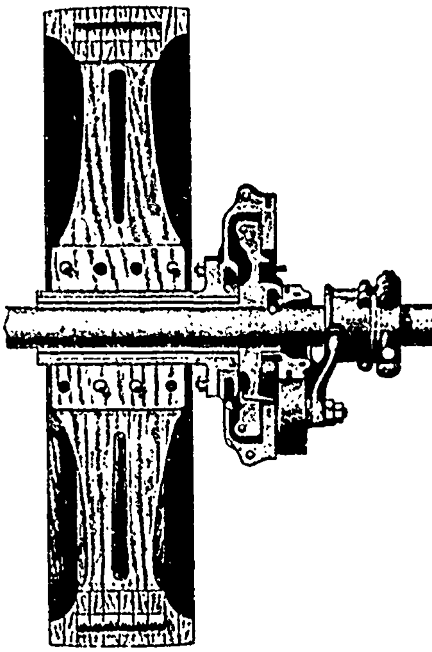
SHOWING SPLIT SLEEVE.



PATENT INTERCHANGEABLE SLEEVE.

same relation that the Dodge and Philion bush bears to the pulley. It enables the manufacturers to carry finished clutches in stock to be furnished with hubs as ordered also from stock or at most with delay of only a few hours. It also enables the owner to keep a clutch on hand, and at the expense of a new hub use it in a shaft of different size or as a cut off coupling, as he may desire.

Many patents have been taken out on the special features, and if the numerous favorable expressions of mechanics and engineers go for anything we feel safe in predicting a large demand



SECTION OF CLUTCH AND PULLEY SHOWING EXTENDED SLEEVE.

for the Dodge patent split clutch. Many shifting devices are shown; one is adjusted to the floor stands used for shaft supports, and another a plain geared apparatus mounted independently and operating through a rock and pinion.

The company issue a handsome catalogue covering their specialties, and are pleased to mail same free to any one interested. Address, Dodge Wood Split Pulley Co., 68 King Street West, Toronto

THE AMERICAN STREET RAILWAY ASSOCIATION.

THE Executive Committee of the American Street Railway Association held meetings on the 27th and 28th of February, at the Windsor Hotel, Montreal, to arrange for the preliminaries of their next annual convention, which will take place in that city on the 15th and 18th of October next, inclusively. There were present Messrs Joel Hunt, President, Atlanta, Ga.; W. Worth Bean, 1st Vice-President, St. Joseph, Mo.; D. G. Hamilton, St Louis, Mo; Granville C. Cunningham, Montreal, Que.; and W. J. Richardson, Secretary-Treasurer, Brooklyn, N. Y.

The chief feature of the convention will be an exhibition of the different electrical appliances used in operating an electric railway. Negotiations are now in progress to admit the exhibits coming from the States into Canada free of duty, a privilege which will no doubt be accorded, as was done for the electrical exhibition held some three years ago in Montreal.

At the last annual convention held in Atlanta there were 1100 delegates present, but the number that will attend the next convention will no doubt be increased, and eclipse all other conventions of the Association previously held.

ELECTRICITY AND ECONOMY.

THE nature of electrical generation and dynamo working is such that only sufficient amount of current required to do the work in is used, so its economy is at once obvious. In factories where the machinery is working intermittingly, and liable to great fluctuation, the economy of driving by electricity is even more marked, as the electric current can be switched on or off with the greatest ease and rapidity, after which crossed belts and fast and loose pulleys appear a heavy and clumsy, not to say unscientific, method of utilizing power.—Manufacturers' Gazette.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

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

HAMILTON ASSOCIATION NO. 2.

Mr. Wm. Norris, the Secretary, writes that while not many new members are being received into the above Association, the organization is otherwise making progress. The open meetings are being continued, and are proving most beneficial to the members. At the last of these meetings Bro. Brice gave an instructive talk on Electricity, touching upon many points with which engineers having electric plants require to be familiar. The Association is about to set about the arrangements for the annual dinner.

BELL TELEPHONE COMPANY.

At the annual meeting of the above company, held on Feb. 27th, reports showed that the gross revenue for the year crossed a million, being $1,012,839, as against, for 1893, $961,174, an increase of $51,665. The working expenses for 1894 amounted to $729,611, as against, for 1893, $724,791, an increase of $4,820. The net revenue for 1894 was $283,227, as against, in 1893, $236,383, an increase of $46,844. A dividend of 8 per cent. was paid and $50,000 added to the contingent account, while $10,698 was placed to the credit of revenue account. The company's assets over liabilities are given at $921,429. The old board of directors was re-elected as follows. Messrs. C. F. Sise, president, G. W. Moss, vice-president, W. H. Forbes, Hon J. R. Thibaudeau, John E. Hudson, Robert Archer, Robert Mackay, Wm. R. Driver, Hugh Paton.

At a special meeting of shareholders it was unanimously decided to float $600,000 worth of 5 per cent. bonds, redeemable in 30 years, the money raised to be expended in the erection of a new building at Montreal and for other purposes.

INJURY TO BOILERS BY GREASE.

It has often been observed that small quantities of grease in combination with deposits lead to boiler accidents. This compound gets deposited on the plates, and the most violent water circulation is sometimes insufficient to remove it. The plates, in consequence, get overheated and accidents result. The introduction of grease inside the boiler should be avoided, especially where the water from the condenser is used for feeding the boiler, by the use of a sufficiently large feed-water filter. The Berlin Boiler Inspection Society had the following case brought under its notice Two single flued boilers, 4 feet 8 inches diameter, 23 feet long, flues 18 to 22 inches diameter, pressure 12 atmospheres, were used to generate steam for a 150 horse-power engine with surface condenser. The installation had only been at work since July, 1893. A considerable portion of the flue of the left boiler had collapsed. This could not be attributed to shortness of water. On examination it was found that nearly all over the boiler a fatty brown slime had been deposited, which, being placed on a red-hot iron, burst into flame. The feed water pump got its water from a large open tank over which a small filter was placed. The condensed water was led to this filter in order to have the grease removed. Unfortunately, the arrangements were so bad that a considerable portion of the grease found its way into the boiler. A similar case was recorded by Mr. Abel at the last meeting of the Markisch Society for Testing and Inspecting Steam Boilers. Four boilers, the feed water of which was heated by the exhaust steam from a Westinghouse engine, after being in use about six weeks, were so damaged that one boiler had to be completely removed; the other three had to receive extensive repairs. An examination showed that the flues were covered with a deposit of fatty slime. An analysis of this showed that about 52 per cent. of it consisted of mineral oils and paraffine, and 27 per cent. of animal fat. It is strongly advised, therefore, that feed water shall always be filtered so as to remove any oils or grease.—Scientific American.

It seems probable that an agreement will shortly be reached between the London Street Railway Co. and the City Council of London, under which the present street railway system will be transformed into an electric system.

CHARACTER SKETCH.

K. J. DUNSTAN.

MANAGER TORONTO BRANCH BELL TELEPHONE CO.

"*Patience is the finest and worthiest part of fortitude, and the rarest too.*" John Ruskin.

THE Hello of the telephone is no longer an object of curiosity with the people of Canada. We have come to accept it as a convenience of modern life that cannot be done without. But what of the men who were associated with this great invention in its earlier days, and to whose enterprise, business skill, and back of that, inventive genius, patiently exercised, we enjoy this system of communication to-day?

Mr. K. J. Dunstan, whose portrait is here presented to ELECTRICAL NEWS readers, does not make any claim to being the inventor of the telephone, but few men in Canada have been more intimately associated with its progress. Of him, it may be said, that he was in at the start of the telephone in Canada and has grown up with the business, by this means possessing an intimate relationship with telephone affairs.

Mr. Dunstan was born in Hamilton, where the first telephone exchange in the Dominion had an existence. In fact, before the telephone proper was known, he was associated with Mr. Baker, who had established in Hamilton what was known as the District Telegraph Co., employing a system of signaling, which preceded the birth of the telephone. When Professor Alexander Graham Bell brought his experiments to a successful issue, and the Bell Telephone was evolved into a reality, Mr. Dunstan became manager of the Hamilton branch. This was in the year 1878. During the years that he was in charge of the Hamilton office he also travelled considerably throughout the province, engaging in the work of inspection, and otherwise promoting the growth of the Bell telephone. In 1891 Mr. Dunstan removed to Toronto, becoming manager of the exchange in the Queen City.

MR. K. J. DUNSTAN.

When one goes back to 1878, a short period in the growth of any great invention, and contrasts these beginnings in telephonic history with the conditions existing to-day some idea is realized of how quickly, in late years especially, the people have learned to appreciate the telephone. Like every new invention they fought shy of it at first, and in Ottawa and St. John, N. B., where the telephone to-day is as great a necessity as anywhere else, it was almost impossible in the early years of the business to get the people of these cities to evidence any practical appreciation of Mr. Bell's invention. The first canvass in Ottawa was a complete failure and no subscribers could be secured. A two weeks' canvass in St. John resulted in the enrolling of one subscriber. These cities to-day have well equipped exchanges, and in business and domestic circles the Hello of the 'phone is familiar to all classes of people.

The growth of the Toronto exchange is naturally a matter of satisfaction to Mr. Dunstan. There are to-day in this city 4,500 telephones, distributed among houses and private residences. Some of the defects that were worrisome to subscribers a few years ago, have been almost entirely abolished, owing to the degree of perfection attained in the construction departments of the work. The Toronto system is nearly altogether worked by metallic circuits, and to a greater extent than is the case in any other city in Canada. A larger proportion of underground work exists in Toronto than in any city of the same size in America. It is difficult to imagine the headquarters of any exchange to be more comfortably and completely appointed than is the case with the Toronto exchange, in the new building on Temperance St. It had been hoped that the new switch board, in course of construction for the exchange would have been completed before this date, when the entire business would be conducted under the roof of the new building. Within probably two months at the outside this end is likely to be attained. This switch board, Mr. Dunstan claims, will be the largest installation board in the world, and will possess many new and valuable features. Three hundred persons are employed in the Toronto exchange.

To Mr. Dunstan, the general growth of the telephone business, throughout the entire Dominion, is a matter of keen interest. Some figures on this point will be interesting. On 31st Dec., 1894 there were 350 telephone exchanges in Canada using Bell instruments. These were represented by 32,485 subscribers, distributed as follows: Business places, 21,733; residences, 10,621; public pay stations, 131; and in addition 528 private line subscribers. For this service 34,595 miles of wire is in use on over 300,000 poles, besides underground conduits and house top fixtures.

An interesting development in the use of the telephone, and this has been largely within the past few years, is the long distance line. In 1877 it was quite a novelty when a line was placed between the residences of Messrs. Baker and Cory, of Hamilton. Then, hardly Professor Bell himself looked forward to the time when conversation would be carried on daily between points up to 700 miles apart. Yet within the past decade long distance telephoning has developed to this extent, and is growing most rapidly, rendering it somewhat difficult to say what successes may yet be scored in this department of the work. Mr. Neilson, of the Toronto exchange, thinks there is no doubt as to the possibility of building lines that would work say from Quebec to Sarnia; the only question is whether wires of that length in Canada would pay. There is good reason to believe that time will solve satisfactorily that question. A great difficulty in the early days of long distance telephoning was the continual presence of induction, making conversations difficult. This trouble, however, has been quite successfully overcome by the almost general use to-day of metallic circuits and copper wire. The long distance telephone of the Bell Telephone Co. of Canada alone comprises 13,091 miles of wire on 5,361 miles of poles, and gives the means of verbal communication between the subscribers to their 300 different exchanges, and also to 262 other places, where they have no exchanges but only toll offices. The great convenience it is to telephone subscribers to be able to communicate with subscribers in other towns, what it means in a business way, and socially, scarcely needs so much as a suggestion to a people who have been so quick to appreciate in a general way the benefits of a telephone service in their own communities.

Mr. Dunstan is not the man to assume any large share of credit for the widespread growth of the Bell telephone system in Canada. He, of course, is pleased with its success in the exchange, directly under his own supervision, and it would be a strange thing if he did not feel a very vital interest in its general progress, watching as he has been able to do its growth from year to year since its first start in 1878 in the city of Hamilton.

In everything that pertains to electrical matters the subject of our sketch takes an intelligent interest. He has been an active member of the Canadian Electrical Association since its commencement, and at the meeting in Montreal in Sept. of 1894 the highest gift in possession of the Association was conferred upon him when he was elected president. Active and energetic in any work he undertakes, and possessed of a measure of geniality and courtesy that is not common to all men, he makes an excellent executive head of one of the most important commercial and scientific organizations of the Dominion.

M. Armagnat notes the various methods for electrically igniting gas in gas engines, and points out the defects and remedies. He points out that the connections usually adopted by having connecting the frame of the engine with both the primary and secondary of an induction coil, is not the best, and often better results are obtained if there is no connection between the two coils; also, that with a reversal of the connection of the two poles of one of the coils, when a common return wire is used, the sparks may become greater or less.

OUR GOVERNMENT TELEGRAPHS THEIR SCOPE AND AND SPECIAL FUNCTIONS.

FROM time to time, it may be found, reference is made with more or less particularity to the Government Telegraph Service in press articles, dealing alike with the colonization and internal development of the country, and with the coast navigation and our marine interests in general; the implication being thereby conveyed that the Government lines are of considerable extent, and that their ramifications serve some general and useful purposes beyond the sphere of operation of the commercial systems of the telegraph companies.

As a matter of fact, the Government lines do occupy a special field, even in the midst, as it were, of a telegraphic environment; and a ready explanation of this is afforded by the consideration that the several districts or sections of the country in which the Government lines are operated are too sparsely settled for the creation of sufficient traffic to warrant the enlistment of private enterprise, while at the same time the character of the service afforded is of such importance to the general welfare, that the Government is warranted in providing the requisite facilities for its performance.

Such being the case, it is self-evident the telegraphs operated by the Government are not calculated to be tangibly remunerative in so far as a comparison of the revenue with the expenditure figures is concerned, but that their utility must be reckoned from some such basis as that of the post office, whose receipts and expenditures have but a secondary place in respect of the manifold interests that are fostered by its maintenance. At the same time it is instructive to look into the matter from the material standpoint, as affording some definite knowledge of what the actual cost of telegraph construction and maintenance is, and to that end reference may be had to the blue-books (the published annual reports) of the Department of Public Works—in conjunction with which the Government telegraphs are administered by the Hon. J. A. Ouimet—for figures on these points which will be found to compare favorably with those to be had in connection with any other of the existing telegraph organizations.

As it was only so far back as 1880 that the Government telegraphs, as such, were established, it may prove interesting to revert to that period for an insight of what brought about the creation of the service. It appears there had been for a long time considerable agitation going on because of the dangers of navigation in the Gulf of St. Lawrence; so many wrecks involving losses of life and property were happening along the coast and on the island shores, that it seemed imperative something should be done to render that particular locality less hazardous, and to this end it was conceived the establishment of telegraphic communication round about there would at least minimize the liability to total wreck of vessels cast ashore, as any such casualty could be reported and steamboats promptly dispatched to the rescue. So favorably was this view entertained by those most directly interested, that even the marine insurance companies advanced the probability of a very material reduction in rates if the telegraph connections were made. The scheme was discussed by Government in a very comprehensive "Report on the Advisability and Necessity of Establishing a Submarine Telegraph System for the River and Gulf of St. Lawrence"—printed by order of Parliament at Ottawa, 1876. And again it was strenuously advocated in "A Pamphlet Compiled and issued under the auspices of the Boards of Trade of Montreal and Quebec: Telegraphy with the Coasts and Islands of the Gulf and Lower River St. Lawrence and the Coasts of the Maritime Provinces—Its Relation to Shipping, Fisheries and Signal Service."—Quebec, 1879. Thus the project took on a broader aspect and assumed more imposing proportions, but it was not all realized at once. In that same year (1879), a "proposed annual grant" of $15,000 was voted by Parliament "for the purpose of establishing telegraphic connection with the Island of Anticosti and the Magdalen Islands and Bird Rock." It was found, however, that this amount was insufficient to induce any company to undertake the work, so the Government decided to capitalize the proposed annual grant, and at the session of 1880 a vote of $200,000 was accordingly obtained for the purposes of construction. The cables were then contracted for and laid, land lines were built to complete the connections, and the whole of those have since been maintained and operated by the Government, along with other extensions and systems elsewhere established in the meantime, under annual appropriations voted by Parliament for their continuance; and in the meanwhile, too, the projects dealt with in the pamphlet above mentioned have materialized. Not only are all of the more important lighthouses electrically connected thus affording the advantage sought of ready communication in behalf of vessels in distress but regular systems of reporting in the interests of the meteorological service and of the fishing industry have been put in operation. And daily reports are communicated to the marine newspapers, of the passages in and out of the Gulf of vessels observed from the several stations, with any of which messages can be exchanged, if need be, by the use of flags and semaphores displayed in accordance with an international code of signals that has been generally adopted and is now familiar to all seafarers the world over. It is in this way that news is obtained and telegraphed of the appearance and whereabouts of ice at certain seasons in the waters of the Gulf, which can thus be avoided by outgoing vessels that would otherwise be exposed to dangers and delays of serious moment in consequence of its presence.

In view of all this, it is appreciative that the representations that were made to bring about the existence of these telegraphs, are shown to have been more than amply justified by the circumstance mentioned in one of the annual reports of the Department (1890), that it was found the predicted probable reduction in insurance rates had actually amounted to 50 per cent. in the interval since 1876, when the statistics were under discussion, and that all this was due to the telegraphs and other features that had been introduced to render the navigation of the Gulf so much less hazardous than it used to be. Whence, it is readily conceived that these telegraphs fill an actual need that must have been hard felt before their establishment.

Turning now to the inland lines; it is found that the Government is not unmindful of what is best calculated to render our outlying regions inviting to prospective settlers. Wherever postal and telegraphic facilities are at hand no one can be said to be actually isolated, and as it is obviously desirable for the common weal that all parts of the country should be in touch, the Government's intervention to this end appears to be calculable where there are sufficient interests concerned to warrant it. Hence, wherever there has been a manifest effort on the part of the people in any section to build up and cultivate a business intercourse, it seems the Government has been found ready to lend its co-operation in the way of affording those reasonable facilities for the development of their resources.

In British Columbia the coal mines and the gold fields are reached, so that the produce can be readily listed in the markets, the trades promoted and the common interests of the people engaged in such industries advanced; while incidentally the settlers along the route of the telegraph lines are alike directly benefitted by being thus brought into touch with the trade centres. The same is true of the conditions in the North West Territory, where widely separated towns are connected by long stretches of telegraph over prairies that will ere long be dotted with settlements whose very creation may in no small measure be contributed to by the existence of such facilities for intercourse with the outside world. As it is, the old adage about straws showing the way the wind blows would find apt application to these inland telegraphs, as the successive changes they undergo afford an object lesson of the rapid settlement and substantial progress that is being made in the country.

As the railways and the active operations of commerce become extended over territory occupied by the Government telegraphs, these latter are absorbed or superseded by the private enterprises whose development has been hastened by their use, while elsewhere new extensions are called for, to be in the same way withdrawn in due course when they shall have served the same useful purpose for which they were designed. In this way a good many changes have occurred in the course of the past few years, but, as might be expected, the Government service as a whole is gradually but steadily increasing in its proportions.

At the present time the Government telegraph service comprises a number of systems, aggregating 2,451 miles of land lines and 206 miles of submarine cable, with a total of 148 offices.

The lengths and whereabouts of these several lines; the years of their construction, and the volume of paid traffic handled in each instance, will be found in the accompanying table. It will be noted that the total volume of the paid traffic is by no means insignificant.

The tariffs imposed by the Government in connection with the inland lines are about the same as those of the telegraph companies, and on the Gulf lines the tolls are very reasonable. For example, any office on the north shore of the St. Lawrence can be reached from Murray Bay, where connection is made with the G. N. W. Tel. Co.'s line, for 25c.; or for offices within 100 miles apart, 15c.; and any office on Anticosti Island can be reached from Murray Bay or from Gaspe for 50c. The tariff to the Magdalen Islands from North Sydney, C. B., is 50c., and the local rate on the Cape Breton lines is 25c., and the same on the Magdalen Islands.

The figures of the blue book for 1892-93—the latest that has been issued by the Department—may be taken to represent the yearly cost of the service. For the 12 months covered by that report the expenditure upon the whole was about $49,000, and the revenue collected amounted to a little over $9,000.

The operation on the whole appears to be carried on in a very systematic and agreeable way. A book of rules for the guidance of the employees generally was issued some time ago, after the working of the lines for several years had developed what was most advantageous and best calculated to facilitate the business of the service, and a standing invitation in furtherance of the same object is given in its introduction :

"Agents are requested to communicate to the General Superintendent, any suggestions they may have to make affecting the improvement of facilities for transacting business in their respective localities. Any suggestions calculated to enhance the efficiency of the service will be gladly received and carefully considered."

It is pleasing to note this, as it affords an evidence of intended encouragement to co-operation, and a desire on the part of the management to cultivate personal interest in the work.

Under the regulations that have thus been established, it appears the divers conditions and requirements found to exist in the different sections of the country can be conveniently dealt with through the offices of several district superintendents, acting under the direction of the head office at Ottawa, in which is vested the direct management and control of the entire service. This important office, for which he was eminently well qualified, was very ably filled by the lamented Mr. F. N. Gisborne, from the beginning of the service until his death in August, 1892, since when these affairs have been attended to in a manner which is understood to be highly satisfactory to the Department, by Mr. D. H. Keeley, who was associated with Mr. Gisborne as Assistant Superintendent from 1882 onwards.

In the list of the District Superintendents, which is given hereunder, there will be found the names of several widely-known and able telegraphers, whose valuable services, it is gratifying to know, the Government has at its command.

Inland Lines : District Superintendents—Messrs. E. Pope, Quebec, for North Shore, Escuminac and Quarantine ; James Wilson, Vancouver, B.C., for Barkerville and Cape Beale ; F. C. Gamble, C.E., Victoria, B. C., for Comox system ; H. Gisborne, Quappelle Station, N.W.T., for Edmonton and Wood Mountain ; J. McK. Selkirk, Leamington, Ont., for Pelee Island.

Gulf Lines : D. C. Dawson, St. John, N. B., for Meat Cove, Mabon and Cape Sable ; C. C. Seely, Grand Monar, N. B., for Bay of Fundy system ; H. Pope, South West Point, for Anticosti ; A. Le Bourdais, Grindstone, for Magdalen Islands ; E. H. Tetu, Pentecost, Q., for North Shore, east of Bersimis.

As part of the equipment of the service, the Government SS. "Newfield" was at the outset provided with the necessary appliances for picking up and relaying the cables, and is made available for the work of repairs in the Gulf when needed. The incidental electrical work in connection with the ship's operations has been personally attended to for several years past by the now acting General Superintendent. It almost invariably happens that when a break-down occurs in a cable, its whereabouts is unknown, and electrical tests have to be made to determine the location of the trouble.

In the course of a recent visit to the head office at Ottawa, there were shown some very interesting samples and specimens of the different kinds of apparatus and materials used in the construction and equipment of the lines ; also the requisites for the various kinds of instrument and battery tests incidental to telegraph maintenance ; one of the latest acquisitions being a machine for the determination of the properties of wire intended for line construction. With such appliances as these the management is enabled to deal with the material needs of the service in an intelligent way, thus ensuring a proper equipment of the lines in order that they may be rendered as reliable as possible ; and it may safely be assumed that so long as this end is had in view the interests of the Government in respect of these useful and important telegraphs will be well conserved and looked after.

Thus much for our Government telegraphs. The service is seen to be an admirable institution ; its management is evidently in good hands, and the policy of its perpetuation unquestionable.

LINES OF THE GOVERNMENT TELEGRAPH SERVICE.

LOCATION	Year of Construction.	Length in Miles: Land Lines	Cables	Total	Number of Offices	Sent* Messages per annum
Newfoundland.—						
Port au Basque to Cape Ray	1881	14		14	2	
Nova Scotia.—						
North Sydney to Meat Cove	1880	151¾	1	152¾	12	5700
Barrington to Cape Sable.	1883	16	1¼	17¼	3	450
Mabon to Chetticamp.	1887	63		63	7	2000
New Brunswick.—						
Eastport to Campobello, Grand Manan and Whitehead Id.	1880	34	10¾	44¾	7	600
Chatham to Point Escuminac.	1885	42		42	5	750
Quebec.—						
Magdalen Islands to Meat Cove.	1880	83	55½	138½	9	500
St. Paul's Island to Meat Cove.	1890	3	20	23	2	50
Anticosti to Long Point	1890	9	21	30	} 0	500
Anticosti to Gaspe. .	1880	242¼	44¼	286½		
Murray Bay to Pt. Esquimaux.	1887	456¾	39¼	496	35	} 18400
Bay St. Paul to Chicoutimi.	1881	92		92	6	
Grosse Isle to Quarantine	1885	48	4¼	52¼	7	3400
Ontario.—						
Pelee Island to Leamington	1888	24	8¼	32¼	7	500
North West Territory.—						
Quappelle to Edmonton and St Albert	1883	607½		607½	14	4200
Moosejaw to Wood Mountain	1885	90½		90½	2	250
British Columbia.—						
Ashcroft to Barkerville	1879	276½		276½	8	2010
Victoria to Cape Beale.	1890	118		118	6	250
Nanaimo to Comox.	1892	81		81	6	2000
Total . .		2451¾	206½	2658¾	148	41550

*Meteorological and signal service messages and fishery reports are handled free of tolls, and are not included in the count.

TRADE NOTES.

The storage batteries manufactured by the Ballard Electric Works, 43 Adelaide St. W., are said to be giving satisfactory service where a current of small voltage is required.

Messrs. Roe & Graham, Ottawa, report the following recent sales of water wheels :—60" to the E. B. Eddy Co., Hull, Que.; 36" to J. Oliver & Son ; 48" to the McKay Milling Co., Ottawa ; 36" wheel to F. M. Pope, Robinsonburg, Que.

The Canadian General Electric Co. have closed a contract with the Winnipeg Street Railway Co. for a 600 H.P. direct-connected railway generator. This machine will be of the Company's standard multipolar type, similar to the 1200 H.P. generator recently installed by them for the Toronto Railway Co.

The Montreal Railway Co. have within the last few days placed an order with the Canadian General Electric Co. for 80 motors of their new C.G.E. 1200 type, together with a large additional order for C.G.E. 800 motors, with which they have had, during the recent severe weather in Montreal, a most satisfactory experience.

Mr. Wm. T. Bonner, of New York City, has succeeded Mr. E. C. French as General Agent for Canada for the Babcock & Wilcox Co., manufacturers of the well known water tube steam boilers of that name. The Babcock & Wilcox boilers are now built in Canada, large shops having been fully equipped with special tools and other necessary plant for handling orders of any size. Mr. Bonner will continue the principal Canadian office at 415 Board of Trade Building, Montreal.

The Robb Engineering Co. has received the following letter from Principal Grant, of Queen's University. "The Mining Institute of Ontario held its quarterly meeting here last week, and we took that occasion of formally opening the Mining Laboratory ; and your engine and boiler were both voted satisfactory. As a Nova Scotian I was delighted that we had so much of our machinery from Nova Scotia, and as this is the only mining laboratory in Canada, I was delighted that you had contributed to its equipment."

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

PUBLISHED ON THE FIFTH OF EVERY MONTH BY

CHAS. H. MORTIMER,

OFFICE CONFEDERATION LIFE BUILDING,

Corner Yonge and Richmond Streets,

TORONTO, - - CANADA.

Telephone 2362.

NEW YORK LIFE INSURANCE BUILDING, MONTREAL.

Bell Telephone 2299.

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

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MR. D. McFarlan Moore, of Harrison, N. J., is reported to have attained very encouraging results in the direction of phosphorescent lighting. "The line which Mr. Moore has marked out for himself," says the Electrical Engineer, "contemplates the introduction of phosphorescing glow lamps on continuous or alternating current circuits of ordinary potential, with the addition of but the simplest auxiliary apparatus." The details of the method by which are achieved the results which Mr. Moore has demonstrated, are withheld for the present, pending the securing of patents.

AT the meeting of the Executive Committee of the Canadian Electrical Association held since the publication of our last issue, quite a number of new members were elected. The members of the Association resident in Ottawa are looking forward with a great deal of interest to the convention of the Association to be held in that city next autumn, and are determined that if possible it shall eclipse anything of the kind held in the past. The history of the Association thus far has been marked by steady progress, and we have strong faith that it will accomplish greater things in the future.

WE hear of two companies being formed, one at Ottawa, the other at Hamilton, to engage in the manufacture of storage batteries. The latter is being formed to manufacture an American battery which is especially designed for the propulsion of electric cars. The inventor of this battery claims that by practical tests he has demonstrated its ability to drive a car one hundred and twenty five miles without recharging. This is the kind of battery that electric railway projectors and managers are looking for. Apart from the possibilities for railway use, the demand for storage batteries for other purposes is we believe sufficient to support at least one Canadian manufactory, provided it can produce a battery that in point of durability, efficiency and cheapness, will compare favorably with those now being imported.

THE paper on "Electricity for Architects," by Mr. John Langton, printed in the present number, was prepared with the view of making clear to the minds of a non-technical audience the meaning of electrical terms and the methods of operating electrical currents. We re-print the paper in the belief that it will prove valuable to students of electricity to whom a thorough understanding of the underlying principles of the science is of the greatest importance.

THE attention of owners and operators of electric lighting stations throughout Canada is directed to the paper on "Central Station Dividends" by Mr. Cecil Doutre, of Montreal, published in part in this number of the ELECTRICAL NEWS. The author demonstrates very clearly the means by which profits can be made or lost, and emphasizes particularly the necessity for skilled superintendents, firemen and engineers, without which the best business manager is powerless to achieve satisfactory results. In this connection an article appearing in the present number, calls timely attention also to the fact that electric lighting might be made more profitable than it often is, if business principles were applied to the operation of lighting stations to the same extent as to electric railways, for example. These are facts which those interested in electric lighting enterprises, whether as investors or managers, cannot afford to disregard.

ELECTRIC railway and lighting companies are finding it necessary to expend large sums of money in defending the increasing number of actions for damages brought against them by persons who adopt the methods of the black-mailer to extort money to which they know themselves not entitled. Managers of electric companies would welcome at as early a date as possible, judgments of the Canadian Courts which would define the liability of such companies in actions for damages and serve as precedents for the settlement of future cases. If, as would appear to be the case, the law as it stands at present does not afford sufficient protection from the assaults of the blackmailer, an effort should be made to have it properly amended. Electric companies, we take it, expect to make compensation for injuries resulting from carelessness on the part of their management or employees, but they should not be allowed to become the easy prey of the blackmailer.

ON the evening of Feb. 25th, and less than half an hour after the employees had left the building, a small upright boiler in a soda water factory on Sherbourne street, Toronto, exploded, completely wrecking the building and knocking out the windows and otherwise damaging surrounding residences. Luckily the absence of employees from the factory and of foot passengers from the sidewalks opposite the building, avoided more serious results. Portions of the outer shell of the boiler were found imbedded in the frozen ground in the yards of the locality, having cut their way through the felt and gravel roof of the factory. The force of the explosion is sufficient evidence that it was not caused by low water. Had five hundred pounds of gunpowder exploded inside the building, it could not have exerted a more destructive force. It is supposed that the fire in the boiler had not been securely banked for the night, and that it had burned up, causing a rise in steam pressure to at least 300 lbs., and that the safety valve was not in proper working-order. This occurrence should suffice to dispel the prevalent notion that while proper inspection and skilled supervision are required for steam plants of large capacity they can safely be dispensed with in connection with small plants. It should likewise direct the attention of the municipal authorities to the necessity for an ordinance to prohibit the locating of factories in the center of thickly populated residential districts, like the one in which this accident occurred.

THE eyes of electricians and manufacturers have recently been turned to the operations of the Cataract Construction Co., for the transmission of power from Niagara Falls to Buffalo and other points. Much speculation has been indulged in as to whether power thus transmitted could be sold to the consumer at a less figure than it could be supplied to him from a local steam plant. The promoters of the transmission scheme are now confronted with another obstacle which was probably unforeseen, and which bids fair to seriously affect enterprises of this character. It is stated that since the proposal to transmit power from Niagara Falls has taken tangible form, the owners of manufacturing sites in the vicinity of Buffalo, which, from their location, would make the cheap power available, have jumped to ten times their former price or from $300 to $3,000 per acre. This advance it is believed will fully offset any advantage which the Buffalo manufacturer is likely to derive from cheap power. Exactly the same principle applies, says the American Machinist, to comparisons made between *manufacturing plants located in Buffalo and* similar plants located in Cleveland or elsewhere. If in each case the annual rental value of the land occupied, or the interest on its actual value be considered as a part of the cost of production—as it should be—it will, we think, be found that things are nearly balanced, i. e., that whatever advantages a given manufacturer may have over another in the matter of cheap power will be balanced or nearly so by the cost of the *privilege of using it*; and this is one of the reasons why manufacturers in Hartford, Providence, Cleveland or Cincinnati need not especially fear the competition of manufacturers who get power at much lower cost elsewhere, unless the owner of the land upon which the factory stands—who may be also the manufacturer occupying it —is willing to ignore its value in making up his accounts; something which he does not usually do if he is wise.

THE use of the gas engine in connection with electric lighting plants is not receiving the attention that it should in Canada, where so many towns have gas and electric plants combined under the same management, and where small and medium sized isolated plants are so frequent in the larger cities. Gas companies neglect their own product, and use steam engines to operate dynamos, when the most superficial investigation into the subject would have probably modified their designs, to their great advantage. A gas company should consider this question, not so much with a view of determining whether it is cheaper to produce a gas light or an incandescent light of equal candle-power; but in order to determine whether gas consumed in a burner to produce light, or in a cylinder to *produce power*, *is the* more efficient method of consumption. Most such combined plants sell the two forms of light at the same, or what are intended to be the same, figures per candle power. If the electric light is more popular than the gas, less gas is consumed, less is produced, and the general efficiency of the gas plant lowered, and *vice versa*. This simply means that the income from the total lighting (whether by gas or electricity) has got to pay interest on capital sufficient for two plants. If gas companies were to make greater efforts to popularize their electric light, and used gas engines instead of steam engines to run their dynamos, the efficiency of their electric plant would rise; and that of their gas plant might be kept fairly constant, because the consumption of gas for power would increase with the extension of the electric service. Presumably all gas companies know how much gas they distil from a certain quantity of coal; and if they do not know how many pounds of coal they burn in their steam boilers per horse power hour, it argues very poor management. There are gas engines in use to-day in Europe and America, whose makers guarantee their performance at so little as 15 cubic feet of gas per h. p. h.; and plenty of them are guaranteed at from 20 to 25 cubic feet per h. p. h. for reasonably large sizes. A manager should therefore be able to compare the price of the coal burnt per h.p. h. to raise steam, with the price of the gas necessary to produce one h.p. h. in a gas engine, and in connection with this he can make another calculation as to the comparative efficiencies of gas consumed in a burner and in a cylinder. Thus, a 16 c.p. gas burner will require on the average 5 cubic feet of gas per hour. One thousand cubic feet of gas will therefore give 200 16 c.p. hours. The same quantity of gas consumed at the rate of 25 c. f. per hour will give 40 h. p. h. This at 75 per cent. electrical efficiency, and using 4 watt lamps, gives 349 16 c.p. hours as against 200 using gas in burners. A gas engine would have to consume 44 cubic feet per horse per hour before the efficiencies of the two methods of consumption would become the same, on the assumed data. Here is a matter which is well worth the attention of gas managers. Lighting is too much regarded from the standpoint of the gas company or of the electric company, and not from a purely unprejudiced commercial one.

and thus it is that lighting companies of all sizes and using all kinds of methods are suffered to manage themselves according to most unbusiness-like principles, and hence fail of success.

THAT electric lighting is an industry requiring special study, not only of its practical, but also of its commercial features, is not so well recognized as it should be. Practical electricity is a most fascinating science, but commercial electricity has also its problems, the study of which often indicates practice that from a commercial point of view is very paradoxical. The spending of an extra amount of money, for instance, in running a system of "secondary mains," utilizing the transformer secondary pressure of 100 volts, instead of the alternator primary pressure of 1,000 volts, will in certain cases be an actual economy. Economy can be observed in the preliminary design of a plant, and subsequently in its operation; but a seeming economy in the design may be the direct cause of an increase in subsequent operation expenses, much greater than the interest on the sum saved by such economy. This proposition is not evident to the untrained intelligence of the non-professional "electrician." The efficiency of large transformers is greater than that of small sizes: the drop of voltage between full and light loads is less in the former than in the latter; and as a rule the price per light is less in the large sizes. Consequently, in a block of houses and stores, where the lights are fairly numerous, the placing of a large transformer at each corner, and connecting all these in multiple or to secondary mains, whence are tapped off the branches into the various houses, will, under certain conditions to be examined in their purely commercial bearing, be a very superior method to running primary mains, and putting on a small transformer for each customer. The increased cost of secondary mains at 100 volts over primaries at 1,000, may well be compensated by the less cost of large transformers per light, and the saving effected in labor and supplies by putting up only four, instead of a number of small ones; and thus, the great advantage of a much better regulation of pressure is obtained at small cost. The desirability of a constant pressure at the lamps is established by the facts that the life of a lamp is reduced about 15 per cent. for every 1 per cent. increase of voltage above that at which it is intended to be run; while its candle power decreases about 5 per cent. for every 1 per cent. decrease of that voltage. In the former case the consumer has to buy a greater number of lamps, because they burn out too quickly; in the latter he pays for light that he does not get. The variation of load on a transformer will always be great, probably ranging from full load at about 7 o'clock on a winter's night, to less than a quarter at 3 a.m. next morning; the variation of pressure on ... lamps will therefore also be great, but greater if small transformers be used, than large ones; and the efficiency of small will be less than that of large sizes, as the following figures will show:

Capacity.	¼ load.	Full load.
12 lamps	84 per cent.	94 per cent.
90 "	94 " "	97 " "

A comparison of costs per light of the two sizes is also instructive:—

5 light transformer	$3.60 per light.
90 " "	$1.05 " "

The efficiency alone of the larger size, at light load, is a considerable saving, to say nothing of the decreased cost. It is points like these that constitute station management, and that help towards dividends.

PREVENTING DECAY IN TELEGRAPH POLES.

A FRENCH engineer has arrived at the conclusion, according to the Railway Review, that the principal seat of decay in telegraph poles is in the ten or twelve inches immediately below the surface of the ground. To protect them he proposes to excavate the soil to this depth around the pole, to clean it thoroughly from soil and all decaying wood, and then to give it a coat of hot tar. The pole is then surrounded by a sleeve of glazed earthenware, which is made in semi-cylindrical halves, to facilitate the putting in place. The annular space between this sleeve and the pole is then filled with some dry material, which is finally capped with a waterproof layer of asphalt or some similar material. The cost is said to be about 50 cents per pole.

THE NEW BRANCH TELEPHONE EXCHANGE AT QUEBEC.

ON February 4th a branch exchange of the Bell Telephone Company was opened in Quebec to take in the subscribers from the St. Roch district. The building, which is situated at the corner of Caron and Charest streets, was built by the Bell Telephone Company expressly for the purpose, and is of white brick with stone foundations, one storey high, with a basement. In this basement are the heating apparatus and the batteries for the operators, transmitters, and other circuits of the switch which require battery power. The cables from outside are also brought into the building here from a pole in the yard, which is placed close to the wall of the building, and pass through the floor to iron terminals, on which are mounted the standard combination lightning arresters, consisting of a heat coil and a carbon plate air space arrester.

The operating room is almost 51 feet long by 21 feet wide, and has light on three sides. Portions are reserved for the operators' cloak room, talking booths, a public counter, and desk room for a clerk.

The exchange is at present equipped for four hundred subscribers, with an ultimate capacity of two thousand. The switch is of the divided type, having one section of multiple board for the trunk operator, on which to give connections called for from the main office, and also some local connections, the remainder of the operator's positions having only the usual jacks and drops. Each operator has charge of one hundred lines. The various parts of the board are of the latest design, such as open jacks, self restoring drops, and the new combination ringing and listening key, such as are being used on the new Toronto switch. From the arresters on the cable terminals, switchboard cables are carried to one side of a Hibbard rack; the other side being connected to the multiple jacks in the first section. From here other cables are run to the connecting boards on the various switches, and thence to the jacks and drops. Chairs of special design are provided for the operators, and both gas and electric light are provided as illuminants. On the whole, this is one of the most modern and best equipped offices the company have.

NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTION.

THERE was a larger Canadian representation than usual at the National Electric Light Association Convention held in Cleveland on the 19th, 20th and 21st of February. Among those who attended from Canada were Messrs. John Langton, Frederic Nicholls and J. K. Kammerer, of Toronto; J. W. Taylor, Peterboro'; Frank Badger, Montmorency, Que., and J. A. Corriveau, of Montreal. The total attendance at the Convention numbered about three hundred. "It was the first of the American Coventions that I had attended," said one of the Canadian delegates, "and I was so disappointed that I am not in the least anxious to attend another. I had polished up my mental apparatus to the greatest possible degree, in anticipation of coming in contact with the brightest intellects of the continent. Judge of my surprise to find the discussions of the tamest character, and largely monopolized by sales agents of the various manufacturing companies for advertising purposes. One whole day was taken up with the discussion of the monocyclic system. I was surprised that the President of the Association made no effort to limit the discussion so as to allow time for the consideration of other subjects of general interest to the electrical fraternity. Mr. Nicholls' paper on "The Lighting of Large Cities," for example, received no discussion whatever. I consider that our Canadian Electrical Association can give the National Association pointers as to how to manage a successful Convention The Canadian Association is noticeably superior in point of the ability of its members to present intelligibly their views upon the subjects up for discussion, and in their knowledge and observance of parliamentary practice."

MONTREAL JUNIOR ELECTRIC CLUB.

Jan. 28th—Paper on "Review of Past Papers," by H. H. Morgan.

Feb. 4th—Paper on "Electric Bells, Batteries and Push Buttons," by T. W. Sutton.

Feb 11th—Paper on "Street Railway Trolley System," by R. H. Street.

Feb. 18th—Paper on "Incandescent Lamps," by E. W. Sayer.

MUNICIPAL ELECTRIC LIGHTING.

TORONTO, Feb. 16th, 1895.

Editor ELECTRICAL NEWS.

SIR,—May I request you to insert the following in answer to Mr. A. A. Wright's questions re Orillia municipal plant, and Mr. J. J. Wright's reference to action recently proposed by West Toronto Junction?

First, Mr. A. A. Wright's calculation of income is based on 1400 lights. I gave "nearly 1400" as the number installed and running. The exact number was 1340. I calculated the income on this figure, and allowed 15 per cent. discount for prompt payments. This discount should have been alluded to, but was inadvertently omitted.

The schedule of rates in Orillia is as follows. (a) ordinary store lighting, 60c. per month per 16 c. p. lamp; (b) stores remaining open every night, 70c. per 16 c. p. per month; (c) Hotels, all night lights, 80c. per light; 12 o'clock lights, 70c.; bed-room and dining-room lights, 30c. per light per month, etc.

Mr. Wright will see that these prices are fair and attainable in most towns that have not the advantage of profiting by the competition of two rival electric plants, under which undesirable conditions I believe he himself operates. I say "undesirable" conditions, because, having been a central station manager myself, I know just how he feels; from the standpoint of public interest, I should regard those conditions as highly proper and satisfactory. To return—there are no "commercial" arcs, and I cordially agree with Mr. Wright in saying that Orillia "*is* very evidently a pretty good paying plant." I am delighted to find that I have carried conviction to the mind of a central station man as to the economy with which the operations of at least one municipal plant are conducted, and I hope to produce several more such arguments.

As to my charging the $570 for carbons against the incandescent plant, readers of the article in question will, on re-perusal, notice that the print reads (just above the table of expenses): "The operating expenses of the entire plant, *arc* and incandescent, are therefore as follows, etc." The carbons, therefore, are properly charged. In stating that "a portion of these items (engineer and fireman) are justly chargeable to arc account," Mr. Wright shows us that his accounting system is inexorable in its adherence to philosophical principles, but I ask his pardon for suggesting that he has missed the point I made, which was distinctly shown half way down the last paragraph of the article: "Thus, it would appear, that working the incandescent plant at two-thirds its rated capacity, brings in a sufficient income to defray its own expenses, pay off its own debt and do the town lighting *free*." It is evident, therefore, that these items were charged wholly to the incandescent plant, in order to show that its income is sufficient to defray all arc expenses, and leave the town arc lighting a clear gain.

I really feel like a criminal, in this discussion, as it is evident that however good may be my intentions, I am not on the "Wright" side. I cannot even feel confident that Might is against Wright. Mr. J. J. Wright's strongest argument is "that Toronto Junctions mayor has recommended the council to get the lighting done by the Toronto Company, if that company will do it at a reasonable figure." This amounts to "it is wrong for Toronto Junction to do its own lighting if any other party can do it more cheaply." Does anyone doubt this? Has anyone stated the opposite? It is an unassailable truism, whose roots spring out of eternal fact. But can this truism be taken as a proof that municipal ownership is expensive? My article contains plenty argument, and is quite open to criticism; let us have a few such criticisms from Mr. J. J. Wright. We have had all sorts of theories, and exposés, and not a little honest invective, and assumptions from all sorts of persons. Let us relegate all that, and also truisms, to the rear, and have solid arguments. Besides, I think an argument taken from Toronto Junction cannot apply to towns situated like Orillia. Toronto Junction can simply tie on its wires to those of the Toronto Lighting Company, and I should be the last person to say that a 50 light plant can be run as cheaply as a 1500 light plant. But Orillia has not got a 1,500 light plant at its doors, nor have a hundred other provincial towns of the same size, so what are they going to do? My article was descriptive of a particular case, governed by peculiar conditions. Any criticism founded on completely different conditions cannot apply. Thanking you for your space.

I remain, yours very truly,

GEORGE WHITE-FRASER, E. E.

MOONLIGHT SCHEDULE FOR MARCH.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1	P. M. 9 30	A. M. 5.40	8.10
2	" 10.40	" 5.40	7.00
3	" 11.00	" 5.40	6.40
4	" 12.00	" 5.40	5.40
5	....	" 5.40	3 20
6	A. M. 2.20	......	
7	" 3.30	" 5.40	2.10
8	" 3.30	" 5.40	2.10
9	No light.	No light.	. .
10	No light.	No light.	
11	No light.	No light.	
12	P. M. 6.10	P. M. 9 20	3.10
13	" 6.10	" 10.30	4.20
14	" 6.10	" 11.50	5.40
15	" 6.10	A. M. 1.00	6.50
16	" 6.10	" 2.00	7.50
17	" 6.20	" 3.00	8.40
18	" 6.20	" 4.00	9.40
19	" 6.20	" 4.30	10.10
20	" 6.20	" 5.00	10.40
21	" 6.20	" 5.00	10.40
22	" 6.20	" 5.00	10.40
23	" 6.20	" 5.00	10.40
24	" 6.30	" 5.00	10.30
25	" 6.30	" 5.00	10.30
26	" 6.30	" 5.00	10.30
27	" 7.00	" 5.00	10.00
28	" 8.00	" 5.00	9.00
29	" 9 00	" 4.50	7.50
30	" 10.00	" 4.50	6.50
31	" 11.00	" 4.50	5.50
		Total,	205.10

REMOVAL OF BOILER SCALES.

THE great bulk of the solid matter deposited from the feed water, remarks the Locomotive, may be removed by frequent and judicious blowing. It cannot all be removed in this manner, however, for where the plates are hot more or less of it is sure to bake on, forming the hard, stony layer known as "scale."

The commonest components of scale are carbonate of lime (limestone) and sulphate of lime (gypsum). Carbonate of lime seldom forms a stony scale. It may collect in large masses and do serious injury to the boiler, but the deposits which it forms are usually lighter and more porous than the corresponding deposits of the sulphate of lime.

Most substances are more soluble in hot water than in cold; but carbonate of lime is a notable exception to this rule, for, although it is somewhat soluble in cold water, in boiling water it is almost absolutely insoluble. It follows from this fact that when feed water is pumped into a boiler, the carbonate of lime it contains is precipitated in the form of small particles as soon as the temperature of the water reaches the neighborhood of 212 degrees. These particles are whirled about for a considerable time in the general circulation, and if the circulation is good they do not usually settle until the draft of the steam is stopped for some reason—as for instance, in shutting down for the night, or in banking the fires for the noon hour.

The best time to remove this sediment by blowing is, therefore, just before starting up at one o'clock, or after the boiler has stood idle for an hour or so at night, or just before beginning work in the morning; for at these times the carbonate deposit has settled into a kind of mud at the bottom of the boiler.

Sulphate of lime differs from the carbonate in being more soluble in hot water than in cold; and it is, therefore, not deposited in the same way. The sulphate deposit is formed at those points where the evaporation (and consequent concentration of the solution) is most rapid, that is, in contact with the shell, the tubes and the back head. Being deposited practically in contact with the iron, it forms a hard adherent coating, which often resembles natural stone so closely that nobody but a skilled mineralogist could tell the difference between them. The best way to treat water containing sulphate of lime is to convert the sulphate into carbonate, and remove the carbonate thus formed by means of the blow-off, as already described. This can be done without injury to the boiler by the use of soda ash, which is a crude carbonate of soda.

STATION DIVIDENDS.*

By C. Doetsk.

In taking into consideration the advisability of putting up a plant of any description, one or two things have got to be looked into very carefully before going ahead with the work—the first, cost of the plant, and secondly, the cost of supplying electricity to consumers. Now, gentlemen, it is not my intention to dwell upon either one or the other, but to try and explain why some plants do not give as fair a return as might be expected for the amount of money invested, and how to apply the remedy. In the majority of cases the reason is found to be ignorance on the part of either the manager or the party who has charge. If a station is not properly managed a satisfactory service cannot be expected, and a poor service is not conducive to gaining new customers or keeping old ones. And again, the operating expenses of a poorly managed plant must necessarily be more than if it were managed otherwise. Sometimes we find plants which are well installed, the apparatus is very good, the superintendent knows his business, local conditions are such that the plant ought to pay a fair return, and yet every year there is a balance on the wrong side of the books. The manager does the buying and manages everything. He enters into contracts which he ought to know would result disastrously to the company. A prospective customer comes along who probably lives in an isolated spot half a mile from the nearest circuit. He wants his house wired, or has it wired and would like to have light, he probably has 15 to 20 lights, and his yearly account would not average more than 3 to 4 dollars a month. The cost of putting up the line and the possible income from same never come into consideration at all; the manager agrees to light his house, and at the end of the year they find, although they have so many more customers, and the station output has increased 10%, there is still a deficit. A coal merchant offers coal at 5% cheaper price than what they are paying. No trial order is given, no sample offered to the superintendent or engineer for their opinion as to whether the article in question is of an inferior grade to what they are using; a yearly contract is entered into, and at the end of the year it is found that instead of the consumption of fuel per electric H.P. being in the neighborhood of 3 lbs., it is nearer 4.

A plant managed in such a way will never pay. The superintendent or electrician in charge may be a first-class man in every respect, and although he is doing his best to run the plant as economically as he can, so as to make it pay, he is handicapped to such an extent by the lack of executive ability and judgment on the manager's part, as to be able to accomplish nothing further than to reduce the balance which, as I said before, is sure to be found on the wrong side of the ledger. Sometimes we find just the reverse state of affairs—the manager is an exceedingly shrewd business man; manages everything to the advantage of the company and does everything to promote its welfare. He is unfortunate enough to engage a superintendent, who, although coming fairly well recommended, does not understand his business. The plant is comparatively new and has only been in operation a year or so. The difference between operating expenses and receipts for the year was so small as to indicate that something was radically wrong. So the directorate or proprietor decides that a change of management would be beneficial to the company's interests. As I said an A1 manager is secured who engages a man entirely unsuited for the work there is in hand. The plant is in bad condition, and there is plenty of room for improvement. Steam pipes are not protected with any suitable covering; exhaust steam is going to waste; cold water is pumped directly into the boilers. Boilers are not properly fired, and are cleaned when it becomes apparent to the fireman that he has to work twice as hard to keep steam up. The dynamo room is pretty much in the same condition—oil is everywhere except in the proper place; loose coils of wire are lying around the floor; carbons everywhere; incandescent lamps, good and bad, in places where they are easily broken; machines not properly cleaned, and the remainder in keeping with the above. The engineer, who knows his business, recommends certain changes and improvements—for instance, that the steam pipes be covered with some suitable covering. He explains that the loss due to convection and radiation is considerable, which we will figure out later; also that by pumping the water directly into the boiler before passing it through some suitable heater, involves a great loss. The superintendent prefers getting along without the above improvements. His policy in regard to the management of the plant is the same throughout. He thinks that if the expenditures are kept low the company will think him a shrewd superintendent, and that his position will be enhanced. In the meantime the coal pile is diminishing at an extraordinary rate; what was a small mountain in the morning is a mole-hill at night. The engineer in a short time looks upon the superintendent with one closed eye, and any suggestions or improvements which he may deem advisable to be carried out he keeps to himself. The superintendent displays the same knowledge and ability in regard to the dynamo room and other departments. Lamps are broken carelessly; no account is kept of the same; everyone has access to the stock room; material is taken for which an account should be given, but is never rendered. Here again, we have a parallel case, except that the positions are reversed—the manager on one side working hard for the company; buying to advantage; entering into paying contracts; looking after the company's interest; seeing that the office staff are doing their duty, and that the office and other departments under his immediate supervision are run as economically as is consistent with efficient work. What he has gained for the company has been lost in the station through the inefficient manner in which it has been operated, and through the false economy on the part of the superintendent.

Now suppose we take an ordinary every-day plant—one which you can find almost anywhere—say of 600 H.P. capacity, using non-condensing engines and operating the Edison 3 wire system; and let us see if we cannot effect a saving by making a few alterations. We will start in the boiler room. Now, gentlemen, I think you will agree with me, when I state that the loss in the furnace is greater than in any other part of the system; therefore, great care ought to be exercised to see that the boilers are handled efficiently. I think the "corpus delicti" of most of the non-paying stations would, on investigation, be found to be right in the boiler room. Firing is a science which few can master, and very few fixed rules or principles can be laid down for the efficient firing of any boiler, as boilers vary exceedingly in construction, and every different grade of coal has its peculiarities. The fireman is the person under whose immediate care the boiler properly comes, and his duties, from not being generally understood, are apt to be undervalued, although they call for more knowledge than is generally supposed. It is not too much to say that a really good fireman is an almost invaluable man, and that he saves his wages to his employer more than twice over by the care and economy which he exercises.

As stated before, the main object is to convert the heat energy of coal into electrical energy. To do this we must get as complete a combustion in our furnace as possible. The firing is only done properly when the fuel is consumed in the best possible way—that is, when no more is burned than is necessary to produce the amount of steam required and to keep the pressure uniform. Now, to attain this end, complete combustion must be attained in the furnace, and this is going on when the fuel is burning with a bright flame evenly all over the grate. Before considering the conditions we must have to attain this end, it may be of interest to find out exactly what the word combustion means. We find combustion is an energetic chemical combination of oxygen with some other substance, accompanied by light and heat. The substance with which it combines is called "the combustible," or when combustion takes place in an ordinary furnace, it is called "fuel," as for instance, coal, wood, oil, etc. The products of perfect combustion are water (steam) and carbonic oxide, and to insure it, a sufficiently high temperature and a sufficient supply of oxygen is necessary. The first step towards effecting the combination of any gas is, to ascertain the quantity with which it will chemically combine and the quantity of air required to supply the amount of oxygen. Much of the apparent complexity which exists on this head arises from the disproportion between the relative volumes or bulk of the constituent atoms of the several gases, as compared with their relative weights. For instance, an atom of hydrogen is double the bulk of an atom of carbon vapor; yet the latter has six times the weight of the former. Again, an atom of hydrogen is double the bulk of an atom of oxygen, yet the latter is eight times the weight of the former, and so on. Coal must be distilled into gas before it can be properly burned, and in order to do this, hot air must be introduced at a temperature which will not cool the gases below the igniting point. A large supply of hot air is needed whenever a fresh lot of coal is thrown into the furnace, as this when first introduced generates a large amount of gas. If insufficient air is admitted, imperfect combustion will take place and therefore waste. An air space in the grate bars must be preserved and arrangement made so that fresh supplies of hot air are introduced above the fire. In nine cases out of ten this air is supplied through the medium of a strong chimney draught, and in regard to same I quote Prof. Rankin, the highest and best authority on the subject. In the 11th edition of his classical work on "The Steam Engine," (page 272), Prof. Rankin shows that with a chimney the best possible draught should be produced by a temperature in that chimney of 600° Fah. above the temperature of the external air, and then he says: "It appears that under no circumstances can it be necessary to expend more than one-fourth of the latent heat of combustion for the purpose of producing a draught by means of a chimney." Continuing Prof. Rankin says: "When the draught is produced by means of a blast pipe or of a blowing machine, no elevation of temperature above that of the external air is necessary, and with a forced draught less air is required for dilution, consequently, a higher temperature of the fire, a more rapid conduction of heat through the heating surface and a better economy of heat than there is with a chimney draught."

Now Prof. Rankin distinctly states that under no circumstances can it be necessary to expend more than one-fourth of the total heat of combus-

*Paper read before the Montreal Electric Club.

tion for the purpose of producing a draught by means of a chimney. Now one-fourth of the total heat of combustion means considerably more than one-fourth of the fuel, because it does not include the unburnt fuel nor the fuel escaping as combustible gases.

With chimney draughts the experiments of the U. S. navy show that the ordinary furnace requires about twice the theoretical amount of air to secure perfect combustion. Prof. Schwackhoffer, of Vienna, found in the boilers used in Europe an average excess of 70% of the total amount passing through the fire, or over three times the theoretical amount, was used. A series of analyses by Dr. Behr on the escaping gases from a well-known make of boilers with chimney draught, show the excess of air to be 42 per cent. of the whole quantity. A series of 12 tests made by the same, with artificial blast, gave an average excess of only 22 per cent. (which was almost a saving of 50%) of the whole quantity, and in a few cases none at all, with only traces of carbonic oxide. So by putting in a mechanical device for creating a draught, we can safely figure on a saving of 20 per cent.

Now what percentage will we gain by putting in a water heater? We are carrying a pressure of 95 lbs., having a temperature of 328° Fah. The best of heaters do not heat the water to above 200° Fah., and as the water has to be heated from the normal temperature to that of steam before evaporation can take place, some arrangement ought to be made so that this should not be done at the expense of the fuel, which should be utilized in generating steam. As stated, the temperature of steam at 95 lbs. pres. is 328°, and if we take 60° as the average temperature of feed, we have 268 units of heat per lb., which, as it takes 1.151 heat units to evaporate one pound of water from 60°, represents 23 per cent. All of this heat, therefore, which can be imparted to the feed water, is so much saved, not only in fuel, but in capacity of boiler. As we heat our water to 200° before pumping it into the boiler, we save 140 heat units, which represents 12.5 per cent. of the fuel saved.

Now let us find out what we are losing through the steam pipes being unprotected. Say we have 300 sq. ft. of superficial area of high pressure piping. The steam has a temperature of 328°, the surrounding air 75°; difference in steam and air 253° Fah. In experiments on bore wrought iron pipe, conducted at Cornell University under the direction of Prof. R. C Carpenter, it was found that the loss due to convection per square ft. per hour in a four inch pipe at a difference of temperature of 277°, was 425 B.T.U., the loss due to radiation 340 B.T.U., making a total 765 B.T.U. At given difference of temperature, the loss due to convection per sq. ft. per hour would be 381 B.T.U., loss due to radiation 305 B.T.U., total 686. As we have 300 square feet of piping, the loss would amount to 205,800 B.T.U. per hour, or 205 lbs. of coal—equivalent to 6.8 H.P. at the switch board. Supposing the average load per hour was 300 indicated H.P., and we were running 24 hours a day. Assuming that it was necessary to burn 4 lbs. of coal per H.P., let us see what we have saved so far. We were burning 28,800 lbs., or 14.40 tons per day. By the addition of the mechanical draught we save 20%, or 2.88 tons per day; water heater 12½%, or 1.45 tons per day; by covering our pipes with one inch of magnesia and one inch of hair felt we save 492 lbs. per day. Taking these figures together we find that we have saved 8,352 lbs., or 4.2 tons a day. I think a fair average price for coal would be about $3.00 per ton, so the saving in plain figures would be $12.60 per day, or $4,599.00 for the year; and instead of the consumption of coal per H.P. being 4 lbs., it would be 2.84.

So much for our engines and boilers. Some stations derive quite an income from the sale of exhaust steam. A concern with which I was connected heated three large office buildings, having a total of 1,340 rooms, for which they received the sum of $1,400, and if I remember rightly the back pressure was only 1¼ lbs. Any company using non-condensing engines can, by the simple addition of a back pressure valve, utilize their exhaust steam for this purpose, if they can find a sale for the same.

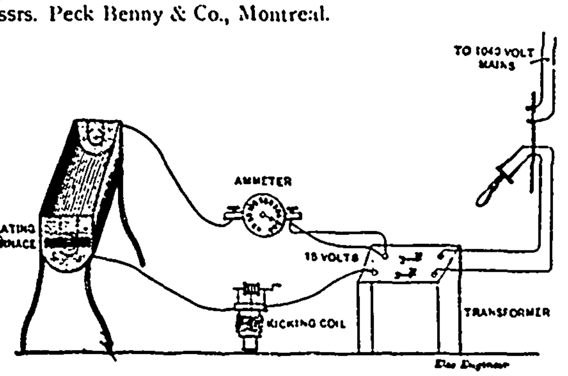
Before going on to the dynamo room and other departments, I would like to say a few words in regard to a furnace which was invented by Monsieur De Linet. Prof. De Linet, who was a lecturer in the Ecole Polytechnique, left Paris in 1870 to avoid conscription in the war, and started business as a boiler maker in London. The old lectures returned to his mind and he decided to put them into effect. This he did, and wherever they have been put in operation the whole series has been changed. By a system of expanding fans and strong mechanical draught, any substance, whatever its nature be, can be consumed. In experiments which have been performed with this boiler, sludge containing 40 per cent. of moisture has been operated on successfully. The Linet Electric Light Co., of Halifax, as the name implies, use the above-mentioned boilers, with such success that they can produce light at the rate of 13s. per 16 C.P. lamp per annum. They dispose of all the town refuse, and anything they can get in the way of refuse from manufacturers, etc. I may mention that from 4 lbs. of carbon lining from gas retorts, which has hitherto been difficult to dispose of, they have produced as much power as can be obtained from one pound of coal in the the ordinary boiler. These boilers are operated with the above success in Halifax, Harrogate and in numerous other places. There is no doubt that there is being wasted every day valuable power producing substances, and no one at this moment can attempt to gauge the vast economy which it is possible to attain in regard to the generation of power, as seems to be foreshadowed by the working of this invention; and it is not too much to expect that the time will come when, by the utilization of every waste product, the economy of living will meet the increased demands for the comfort of the masses, and will go some way towards turning the luxuries of to-day into the necessities of the future.

(To be Continued.)

A NOVEL ELECTRIC FURNACE FOR HEATING IRON STRIP.

THE variety of ways in which the electric current can be applied for heating purposes seems to be steadily on the increase. Thus the heat can be applied directly to the body by passing the current through it either by the direct current or by the alternating current as in Prof. Thomson's welding processes. It can also be subjected to the arc as in the Benardos and like processes. Again it can be heated under water as in the recently developed Hoho process, and finally, the object to be heated can be brought into contact with another body previously heated by the passage of the current.

It is an application of the last mentioned kind that has recently been made in Montreal, where the Montreal Electric Co., by order of Jas. W. Pyke, Canadian representative for Messrs. Siemens & Co., have lately installed a furnace for heating iron strip used in making horse-shoe nails, at the rolling mills of Messrs. Peck Benny & Co., Montreal.



ELECTRIC FURNACE FOR IRON STRIP.

The accompanying engraving shows the arrangement. The local lighting company's mains are run in and deliver current at 1040 volts alternating to the Siemens transformer which reduces it to 12½ or 15 volts as required. The secondary flexible cables pass through an ammeter built on the dynamometer principle, also through a kicking coil which has a movable core, and thence to the furnace.

The furnace consists, says the Electrical Engineer, of a carbon tube, 24 inches long, with a bore of 1 inch, and walls ¼ an inch thick; the tube is covered over with sand. The current at 15 or 12½ volts passes through this tube, bringing it to a white heat. 500 amperes is the usual current allowed, but at starting it is increased a little to hasten the heating up of the carbon which decreases its resistance, and the current is then lowered to normal. It is intended for continuous feed, and will heat five feet of strip per minute. There was some doubt that the heat could be got up, but this has been conclusively proved by the experimental apparatus described above.

ADVANTAGES OF WOOD PULLEYS.

The practical advantages of wooden over iron pulleys are briefly summarized by Power and Transmission as follows.

Saving in power by better traction surface for belt, 33 per cent.

Saving in weight, 70 per cent.

Reduced size and weight of shafting, hanging, etc.

Corresponding saving in power required to overcome friction in bearings, etc.

Gain in safety speed limit, 400 per cent.

Saving in time in putting on or off the shafts.

Saving in time in procuring pulley when wanted.

Saving in avoiding mutilation or distortion of shafting.

All these considerations become augmented in importance as speeds are increased, and are, therefore, of especial interest to all who are operating electrical machinery.

ELECTRICITY FOR ARCHITECTS.*

By John Langton, Toronto.

The engineer or architect will find that, though the quantities dealt with in electrical work may be new to him, the ideas involved are largely the same as he is already familiar with in other branches of physical science. There is a common impression to the contrary, and this no doubt is partly due to the peculiar names of the practical electrical units: volt, ampere, &c.

These are merely arbitrary names, agreed upon by international convention, to shortly express compound units, and so avoid the repetition of cumbersome phrases. It is, for instance, as if it were agreed to call the ordinary British unit of fluid pressure a Newton, so that we might say shortly, but with perfect definiteness, 75 Newtons, instead of 75 pounds pressure per square inch above the atmosphere. Electrical units are in this manner named after eminent men of science. The Volt, after Volta, the discoverer of the galvanic battery, the Ohm, after Ohm, the discoverer of Ohm's law, the Ampere and Colomb, after the French physicists of the same names, the Farad, after Faraday, the Henry after Joseph Henry, and the Watt, the unit of power, appropriately named after James Watt.

In the common commercial uses for electricity for light and power, which the architect has ordinarily dealt with, the main ideas and phenomena present close analogies to the familiar facts of the pressure and the flow of water—so much so that the readiest way of getting a very fair general idea of commercial electricity is to consider the facts concerning it as being illustrated by the similar facts of hydraulics.

I will endeavor briefly to present this analogy, but I must ask you to remember that it is of course nothing but an analogy. I do not mean to imply that an electric current is in any sense a flow of a material fluid, merely that the results are very much as if it were a kind of fluid.

Referring to Table I, - The 1st column gives the names of the electrical units which measure the four electrical quantities involved in ordinary light and power work. The 2nd column shows the letters by which they are symbolized in formulae. The 3rd column gives the electrical quantities which the units designate. The 4th column states the general ideas involved; and the last column the hydraulic quantities which are analogous to the electrical quantities in the 3rd column.

Table I.

Name of Electrical Unit.	Symbol.	Electrical Quantity	Idea.	Analogous Hydraulic Quantity.
Volt.	E	Dif. of Potential. Electromotive force (E. M. F.)	Pressure.	Head or pressure of water.
Ohm.	R	Resistance.	Wasteful Resistance.	Friction of pipes and channels.
Ampere.	C	Current.	Rate of Flow	Flow per second.
Watt.	W	Power.	Rate of doing work.	Power.
			746 Watts = 1 Horse Power.	

OHM'S LAW.

Current = Pressure ÷ Resistance.

$$\text{or Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

$$\text{In Symbols, } C = \frac{E}{R}$$

$$\text{or, } R = \frac{E}{C}$$

$$\text{or, } E = CR$$

ELECTRICAL POWER —(Kilowatt = 1000 Watts.)

Watts = Volts × Amperes

$$\text{In Symbols, } W = EC$$

$$\text{or, } W = C^2R$$

$$\text{or, } W = \frac{E^2}{R}$$

As the flow of water is due to difference of level or head, so is a current of electricity due to a difference of electric potential. And in both cases the amount of the flow through some path provided for it, is dependent—1st, on the head or pressure which causes it; and 2nd, on the frictional resistance which the provided path opposes to that flow, and in both cases the work expended in overcoming this resistance appears as heat. With the same resistance, the greater the pressure the greater the flow. With the same pressure, the greater the resistance the less the flow.

In electrical work, the relation between the pressure, the resistance and the current is a very simple one, and is expressed by Ohm's Law, which is that "The current is equal to the pressure divided by the resistance," or that the current is equal to the ratio of the pressure to the resistance. This is a definite numerical statement that the number of the amperes is equal to the number of the volts divided by the number of the ohms. For instance, 100 volts applied to the ends of a wire whose resistance is 50 ohms, will produce in the wire a current of 2 amperes. With 1000 volts and 500 ohms, the current would still be 2 amperes. And the same current of 2 amperes would be produced with 10 volts and 5 ohms.

Now as to the unit of power. In a fall of water, the weight of the water in pounds multiplied by the number of feet fall or head, is its energy—that is, its capacity for doing work—in foot pounds. And consequently, the rate at which this energy is developed, the rate of doing work, that is to say the *power* of the fall, is measured by the rate of flow multiplied by the head. In mechanical units 33,000 foot pounds per minute is 1 horse power. Whether the flow is 33 pounds per minute under 1000 ft. head, or 1,000 lbs per minute under 33 ft. head, or 33,000 lbs. per minute under 1 foot head, the power in each case is the same, namely 33,000 foot pounds per minute, or 1 horse power.

Similarly in electrical units, power is measured by the current multiplied by the E. M. F. The watts equal the volts multiplied by the amperes. 1000 volts and 10 amperes, 100 volts and 100 amperes, 10 volts and 1000 amperes, all give the same power, namely 10,000 watts or 10 kilowatts.

Since it is the same thing that is measured in both cases,—power—there must be a definite numerical relation between the electrical and mechanical units, which is that 746 watts equals 1 horse power.

In buying electric power at a rate of, say, 4 cents per horse power hour, it is a very simple matter to calculate the cost of the current consumed. Power circuits supply current at a constant pressure. 250 volts is one usual pressure. If the current used is 3 amperes, the watts are 3×250=750 watts; practically 1 horse power, and costing 4 cents per hour. On a 125 volt circuit, a 6 ampere current would mean 1 horse power. So that for a general rule, multiply together the average amperes, the volts and the hours. Divide the product by 746 and the quotient will be the horse power hours consumed.

The resistance of an electrical conductor is analogous to the hydraulic friction in pipes; but whilst the mechanical friction in pipes varies according to the most complicated rules, the resistance of conductors is fortunately governed by very simple laws. It depends only on the material, the area of cross section and the length of the conductor. And fortunately again a cheap metal, copper, is one of the best conductors. It is second only to silver, which is better still, but only by a small percentage. The resistance of iron is between 6 and 7 times that of copper. Copper is therefore universally used for wiring, and we need only consider the effects of area and length, which are that the resistance of a wire varies directly as the length and inversely as the area.

Suppose the resistance of a wire 1 foot long and of a certain cross-sectional *area is 1 ohm; if 2 feet long it would be 2 ohms; if 10 feet, 10 ohms.* Another wire of 10 times the sectional area and 1 foot long would be 1-10 of an ohm, or if 10 feet long, 1 ohm. There are plenty of published tables of the resistance per foot of copper wires, and by the aid of this simple relation between resistance, area and length, they may be extended to any actual case. The question of resistance is of direct concern to architects in the wiring of buildings, but its bearing will perhaps be plainer after considering as briefly as possible the three systems of lighting in general use:

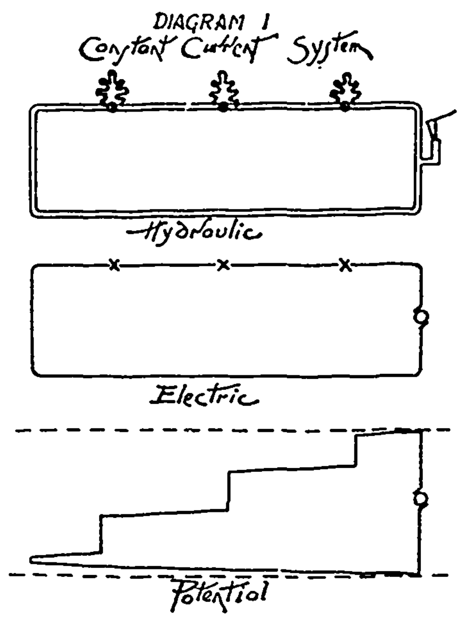
I. The constant current system, which is generally used for lighting by arc lamps.

II. The constant potential direct current system, used for incandescent lamps and for motors.

III. The alternating current system, used for incandescent lamps.

These can all be very well illustrated by analogous hydraulic systems, and for this purpose I have prepared diagrams 1, 2 and 3.

Take first diagram 1—the constant current system. Here the pump represents the dynamo, which maintains a steady flow circulating round the



main pipe. At intervals in the main pipe are stop cocks, and round each of them a by-pass consisting of a long pipe, which opposes a high frictional resistance to the flow, so that the pump must exert greater pressure to maintain the same steady flow. These by passes represent the lamps, in which the whole work done in forcing the current through them against their resistance, appears as heat, raising the temperature of the carbons to such a degree that they give out light. It is obvious that except for the constant resistance of the main pipe, a resistance which is made small, the work the pump must do increases directly with the number of the by-passes the flow must traverse; and, since the flow is constant, it follows that this increased work is due entirely to increased pressure.

Underneath the hydraulic diagram is that of the corresponding electric system, representing a dynamo and arc lamps. The amperes are the same no matter how many lamps are burning, but the dynamos must generate about 45 volts for each lamp burning.

Underneath this again, I have drawn a diagram of potentials, which shows graphically how the difference of potentials established by the action of the dynamo is consumed in different parts of the circuit. It is as if the dynamo were a pump raising water to a height, from which it flows down through the channels offered by the different parts of the circuit back to the pump, which again raises it to retrace the same course, maintaining a constant circulation.

Starting at the highest potential established by the dynamo, the potential gradient falls gently, owing to the slight consumption of volts required to overcome the small resistance of the main conductor. When it reaches the first lamp there is an abrupt fall, by the amount of the volts consumed in forcing the current through the high resistance of the lamp. Then follows a gentle grade to another abrupt fall at the next lamp; and so on to the last lamp, from which there is a last gentle grade back to the dynamo through the return wire.

When the same current passes through one lamp after another the lamps are said to be connected in series.

Turning to Diagram 2—the constant potential direct current system—the hydraulic diagram is an ordinary waterworks system, with the addition that all water used is discharged into a main return pipe which leads back to the pump, and from which the pump draws its supply.

The function of the pump is to maintain a constant difference of pressure between the mains. Each cross pipe from main to main takes whatever flow its frictional resistance will allow the main pressure to produce. And it is obvious that as more cross paths are opened, the increased work the dynamo must do, is due to the increased flow; the pressure remains constant.

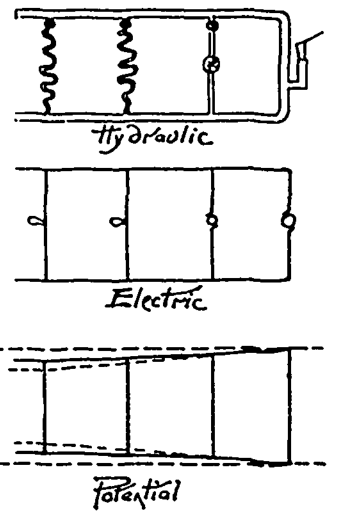
*Paper read at the fifth annual convention of the Ontario Association of Architects.

In the electric diagram underneath, the high friction cross tubes are replaced by incandescent lamps, and the water motors by electric motors.

The potential diagram shows that the pressure in the mains cannot be quite constant, since there must be some fall of potential in the main conductors, and the amount of this fall is less when there are fewer lamps burning, i.e., when the total current is less. The potential gradient is

DIAGRAM II

Constant Potential Direct Current



greatest near the dynamo where the conductor has to carry the total current, but the grade gets flatter and flatter as the current diminishes, by the amperes subtracted at each cross path. These potential gradients are repeated in the reverse order in the return wire.

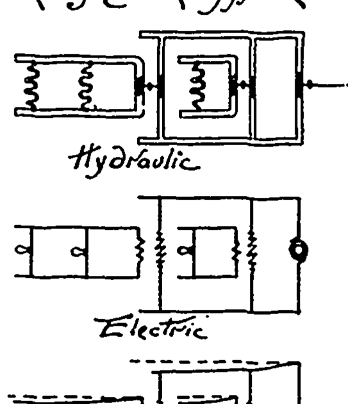
The form of gradient drawn is that for a conductor of uniform size. But if the conductor is reduced at each cross path so that its area always bears the same proportion to the amperes carried, the potential gradient would be the same throughout, and a continuation of the first grade starting from the dynamo, as is indicated by dotted lines.

When lamps are connected side by side, so that each takes its own separate current, the lamps are said to be connected in parallel, or in multiple.

There remains the alternating current system shown by Diagram 3. The pump in Diagrams 1 and 2 produces a flow always *in the same direction*, representing a direct current of electricity. In Diagram 3 the pump is re-

DIAGRAM III

Alternating Current System



placed by a movable piston in the main pipe, which being oscillated from one side to the other, produces a pressure first in one pipe and then in the other, with an accompanying back and forth flow which will vary in amount according to the number of cross paths open. This represents the primary circuit, to which the lamps are *not* connected. The object of an alternating system is to save in the cost of main conductors by transmitting power with a small current at a very high pressure. But for convenient and safe use, this power must be transformed into a larger current at a lower pressure, in a secondary circuit to which the lamps are connected. It is the peculiarity of the alternating system, that this can be done with very little loss and without any moving mechanism. The actual means by which this is effected in the "transformers" or "converters," are beyond the scope of this paper, but a simple mechanical contrivance in the hydraulic system will give us analogous results. A sliding piston in the small primary cross pipe and another piston in the large secondary pipe are connected by a bar pivoted in the middle, so that the two pistons oscillate together and move equal distances. If the area of the secondary piston is, say 10 times that of the primary, a secondary pressure 1-10 that of the primary will balance the the contrivance, whilst a secondary flow of 10 times the primary is produced by any oscillation.

The electric diagram shows the alternator and primary circuit, feeding two separate secondary circuits through two transformers.

The potential diagram for both primary and secondaries is similar to diagram 2.

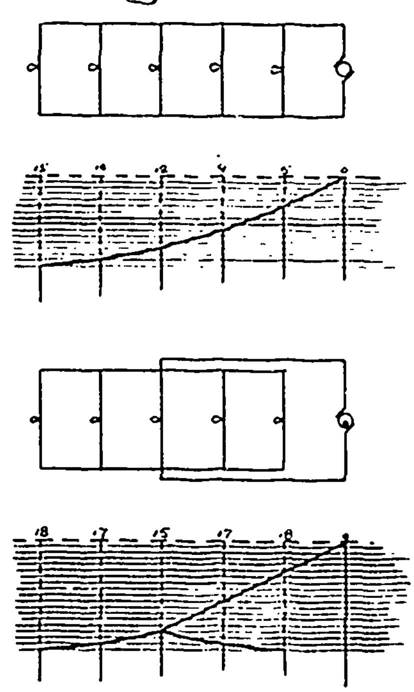
I may say parenthetically that the hydraulic analogy goes still further. The effects of the inertia of water represent excellently those of the electric quantity, self induction, whilst, if the pipes are made elastic, the results would be very similar to those due to electric capacity. But as inductance and capacity are inappreciable in such work as an architect will ordinarily have to deal with, I have not considered them in this paper.

In wiring for incandescent lamps the object is to maintain as nearly as possible a constant difference of potential between the terminals of the lamps. But when, at different times, there are are at different points on the same line, different numbers of lamps burning, it is impossible that the volts at all points should be always the same. And the question is, what variation is permissible?

An incandescent lamp is simply a carbon wire of high resistance, which the current passing through it heats to incandescence. But the resistance of the carbon decreases as the temperature increases. Therefore a rise or fall in the volts causes more than a proportionate rise or fall in the amperes, and the consequent heat and temperature. Also, the light given out increases much more rapidly than the temperature. Roughly speaking a variation of 1% from the rated volts of the lamp, up or down causes a variation of 5% in the light. And it is informally agreed that 2% total variation in volts at any lamp constitutes good and satisfactory regulation. This variation is of course reckoned between the maximum and minimum load--not between full load and no load. If a group of lamps is fed by a wire direct from the constant volts of the source of supply, and the lamps in the group are always all turned on or off together, the drop of volts in the wire may be any amount, and yet because it will be always the same, there will be no variation in the volts when the lamps are burning.

But besides minimizing the variation in the volts at any one lamp, it is desirable that the lamps in the same building should all get about the same volts, so that the same class of lamp may be used interchangeably throughout the building. This is the object of the feeder system of indoor wiring, in which feeder wires carry the current to convenient points in the main wires to which the lamps are connected. Diagram 4 shows graphically the effect on the distribution of volts.

Diagram IV



The consolidation of experience in wiring, into practical rules, embodying safe practice as regards danger from fire, has been performed by the Fire Underwriters Associations. Their rules and regulations are published, and give in detail the minimum standard of safe wiring. The wiring must be at least as good as the rules prescribe, to avoid trouble with fire insurance. Among other things the rules prescribe the greatest amperes different sized wires may carry, and here is a point where they are not necessarily a sufficient standard to guide the architect. The Underwriter's aim is a single one, safety from fire; the architect has an additional aim, good and unvarying light, and our previous considerations concerning the resistance of wires, will show *how these objects are not simultaneously attained.*

The work spent in forcing a current through a wire generates heat in the wire, and the degree the temperature will rise to depends upon the relation between the rate at which the heat is generated and the rate at which it is got rid of. Now the rate at which heat is generated, is the rate at which work is spent in forcing the current through the resistance of the wire, i.e., it is the watts spent in the wire. And from Table 1, watts = (amperes)^2 × ohms. But we have seen that a long thick wire and a short thin wire may *have exactly the same ohms resistance. With the same current the heat* generated is the same in both. How about the resulting temperature? In the long wire the heat generated is spread over a greater length. The heat generated per foot run is less, and, the long wire being thicker, it also presents greater surface per foot run for cooling by radiation, convection or conduction. Obviously the short thin wire gets much the hotter. The safe carrying capacity of wires, both exposed and cased, laid down in the Underwriters' rules, is really a statement of the heat generated per foot that the wires can get rid of without *becoming dangerously warm. This is independent* of the length of the wire. The heat generated per foot remains the same, but the longer the wire, the greater the total heat and the greater the total volts lost in forcing the same amperes through the resistance of the greater length. But the total drop in volts is what the architect must limit in order to get good and steady light. He must therefore be guided by the total resistance, and the ampere capacity of the Underwriters' rules is useful to him only as setting the inferior limit to which he may reduce the size of the wires.

With regard to the different classes of wiring—exposed wiring on cleats or knobs is best for factories, but for domestic work it is only suitable in stores or houses where hanging kerosene lamps, or exposed gas pipes stapled to the walls and ceilings, would be the alternatives. What is called concealed work, in which rubber covered wires are run between floor and ceiling and brought out only where brackets or hanging fixtures are to be placed, is probably the most suitable for the ordinary run of dwellings. Where once in, there is little liability of its being disturbed. But in larger buildings, warehouses, stores and such like, where there are likely to be changes in partitioning off the space, and in the distribution of the lights, to suit different tenants, or the same tenant at different times, wires run in mouldings are by far the most convenient. They are not only most readily accessible for changes of wiring, but the wiring is much less liable to damage by workmen in other trades making repairs. The principal objection is the unsightliness of lines of mouldings straggling all over the ceiling to wherever a lamp is needed. But moulding work has frequently many advantages of convenience to recommend it. Architects, I believe, are always looking for a "motive" in design. Mouldings can be made of any section, and perhaps they might be used to panel off the ceiling in some decorative pattern, suitable to any probable distribution of lights, giving a wide choice of paths for wiring and points for outlets. But this touches the artistic side of architecture, which is beyond my province. The best class of wiring is interior conduit work, in which buildings are piped with strong non-metallic, waterproof and poorly combustible tubing, and wires subsequently drawn into. This is particularly suitable to such work as the best class of office buildings. And where it would be too expensive to carry throughout a building, it may sometimes be used for the main lines to centres of distribution.

When incandescent electric lights were first introduced they were distributed on wall brackets and hanging fixtures in the same manner as gas jets, as if this were the natural arrangement of lights, instead of having originated in the necessity of keeping gas jets within reach for ease in lighting, and in keeping them away from walls and ceilings for fear of fire. This force of habit for some time prevented, and in a measure still prevents full advantage being taken of the possibilities offered by electric lights for getting better illuminat on with the same amount of light. For a desk light or a reading light we cannot do better than replace the shaded oil lamp or gas drop light by a shaded electric lamp, but for the general illumination of a room the incandescent light can, in general, do much better. The illumination we perceive depends not only on the amount of light reflected from an object, but also on the amount of the reflected light the eye takes in, and with lights a little above the level of the eye, we are always partially dazzled by them, and our perception of surrounding objects is indistinct compared with what it would be if the lights were out of sight. To get the best illumination for the quantity of light, a room should be lighted as a picture is lighted for exhibition. Electric lamps high up near the ceiling remove the dazzling effect and at the same time give a more generally diffused light, especially if there are light tinted walls and ceilings to reflect the light without much loss.

For lighting large rooms, arc lamps are used to a considerable extent on the continent of Europe, constructed so that they throw all their light on a white or light tinted ceiling, the room being thus lighted entirely by reflection from the ceiling. The result is a diffused light as shadowless as diffused daylight.

Now with regard to uses of arc and incandescent lights. Diagram V is copied from one by Prof. Nichols, of Cornell, embodying the results of experiments made by him, and is instructive in illustrating the difference of light from different sources in quality, as opposed to quantity.

This diagram represents the brightness of different parts of the spectra of the electric arc, clear daylight and clouded daylight, in comparison with the same colours in the spectrum of an incandescent lamp. The brightness of the latter is taken as the standard in all parts of the spectrum, and is represented in the diagram by the horizontal line at the height 1. The other spectra are reduced to the same brightness at the yellow line D, and their brightness in other regions of the spectrum is shown by curves.

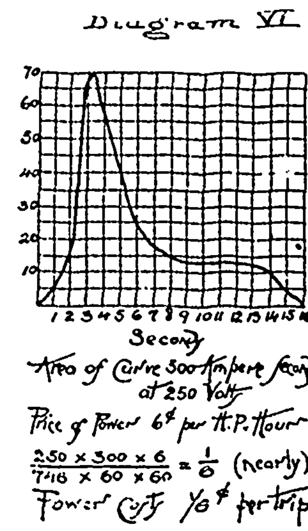
Curve I represents daylight on a cloudless summer day.
Curve II represents daylight under a densely clouded sky.
Curve III shows the light from an electric arc.
Curve IV is from the lime light.

The abrupt rise and almost immediate descent again of curve III indicates a narrow but very bright band of light in the violet end of the arc spectrum, which accounts for the value of the arc light in photography, and also explains the predominant bluish tinge of its light.

The curves show how far all artificial illuminants fall short of equalling the quality of clear daylight, which latter must always be our standard of perfect white light. Even the light of a very dull day is a better all round light than an arc light or lime light of equal general brightness.

Lights are usually rated by candle power, and this is gauged by the relative blackness of shadows thrown on a white ground. Candle power therefore merely measures the ability to distinguish between black and white. For this purpose the yellow rays are much the most effective, but the blue and violet rays are the most useful for showing the distinction between colors, that is, for bringing out the colors of natural objects. And this being so, the curves show that the incandescent lamp gives us the most of that kind of light wanted, for reading or writing, whilst the arc light gives a closer approach to the effect of daylight upon colors. In addition to positive utility, the feeling of suitability has a value. The incandescent lamp, with its warm yellowish red glow, gives a cheerful and cosy air to a small room, where an arc lamp would be simply garish. In a large hall or store, to which the idea of cosiness is inappropriate, the same light that makes a small room cheerful may give only an impression of dullness, whilst the arc light would give an agreeable effect of brilliancy. Of two large stores side by side, one lighted by arcs and the other by incandescents, the arc lit store has in general a more attractive air of being brilliantly lighted, although, measured by candle power, its actual illumination may be decidedly inferior.

Diagram VI is a curve of current consumed in one trip of an electric elevator.



tor. The time in seconds is measured horizontally, and the amperes vertically. This is a diagram from an actual elevator, running 250 feet per minute in a three-storey building. I have taken several such diagrams from different elevators and they all have the same general form as the one shown. I have chosen this one of an elevator having a short run, in order to better bring out the effect on the current consumption of frequent stops. The peak at the beginning of the curve shows the large current required to start the car and acce'erate it to full speed, in comparison with the small current needed—from 7th to 14th, second in diagram—to keep the car in motion after speed has been attained. Nevertheless, even in this unfavorable case, the curve shows the very small cost of power per trip.

For the diagram given the cost is only 1/6 cents per full trip one way, at the rate charged in Toronto for very intermittent use of current, which is 50% higher than the regular Toronto meter rate for power supplied to an elevator in constant use.

Hitherto the application of electricity to architecture has owed little to architects. Trade competition has forced in electric power to take the place of power from other sources which had been already applied to elevators, pumps ventilating fans, &c.; but beyond this little has been done. The convenience of, electric power has certainly led to the extension of mechanical ventilation, with its steady displacement of a fixed volume of air per minute, independent of the degree of dryness or temperature which makes ventilation by natural draught so variable. In ventilation architects have been fairly quick to utilize the opportunity afforded them. But in the larger problems of architecture, the possibilities of applying electricity seem to have received little or no attention. An illustration of what I mean is what might conceivably, though not probably, be the effect of cheap electric power in modifying the design of dwelling houses. If it were desirable to use elevators it would not be very difficult to devise perfectly safe methods of operating them without trained attendance, and a constantly used elevator would have almost as great an effect in modifying house planning as the substitution of stairs for ladders. Supposing such a use of elevators were practicable; whether it would be desirable, whether it would really add to the comforts and conveniences of life, nobody can say so well as the architect, who alone is trained to appreciate at their proper value all points bearing on such a question. And that is the point I wish to bring out by the illustration. Whether in the future electric ty is to play any part in modifying architecture; whether it be of any real assistance to the architect in dealing with the particular problems of his profession, depends principally on the architect himself. The electrical engineer must co-operate in devising working details, but if the applications of electricity to architecture are ever to be more than superficial, the initiative must come from within, not from without.

AN ILLUSTRATION OF POWER.

If it were possible, says the Polytechnic, to place 300 oars on each side of the ocean steamer Campania, making 600 oars altogether, each worked by three men, there would be 1,800 men at work at one time. As they could not work continuously for twenty-four hours, but only for a total of eight hours each man, divided into four watches, it would be necessary to have a crew of 5,400 men to man the oars. If six men could develop 1 H.P., the total horse power developed by the 600 oars handled by 1800 men would be but 300, as against 30,000 in the Campania, or the same power would require the employment of 180,000 oars and a crew of 558,000 men to manipulate them.

The American Bell Telephone Company has appealed to the United States Circuit Court of Appeals against the decision of Judge Carpenter declaring the Berliner patent, No. 463,569, void.

THE ONLOOKER.

BETWEEN fifteen and twenty companies, asking for powers to operate electric railways, have made application to the Ontario Legislature this session for incorporation. The fact is evidence of the important part electricity will occupy in the railways of the near future. The Onlooker heard comment on this point by experts in engineering, like Mr. Wm. Jennings, C. E., and Mr. Rutherford, chief engineer for the Canadian General Electric Co., (Ltd.) It is hardly likely, should letters of incorporation be granted to all the companies applying, that they will enter actively into the work of construction at once. Mr. Jennings felt assured, however, that certain of the projects now contemplated would be entered upon this season, and the Onlooker at the time he chatted with Mr. Rutherford, found that he was then in communication with the promoters of one of the railway companies included in the list. The extension of several roads already in operation will likely be prosecuted as soon as the weather permits. These will almost certainly include an extension of the Galt and Preston road to Hespeler, and certain work on the Guelph road. The Onlooker took occasion last month to point out where possible mistakes might be made in a too rapid development of the electric railway. The very fact, however, that a cautionary signal had to be raised, adds emphasis to the leading position electricity will play in the railroads of the future. When one contrasts the railroad of less than half a century ago, with its imperfect and faulty construction, and entire barrenness of the thousand and one conveniences the travelling public enjoy to-day, some conception may be realized of how great a work has been accomplished in a short time. With electricity, than which no science is forging to the front with so great rapidity, clamoring for the foremost place as a method of railway propulsion, what will another half a century bring forth—nay another decade? Electricity is already coming into general use for lighting cars. It is used to no small extent for heating cars; and at Baltimore, an electric plant is rapidly approaching completion that is to provide power for an electric motor of sufficient capacity to move heavy trains through a tunnel half a mile in length. A recent engineering authority in noting this circumstance, significantly asks: "If this can be accomplished may we not expect to see electricity supersede steam as the motive power of the locomotive?"

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The third, and in many respects, the most serious of the recent Toronto conflagrations, which resulted in the destruction of the large seven-storey building of Mr. R. Simpson, and other adjacent buildings on Sunday morning last, has caused the people to renew the enquiry, what has been the cause of these fires? At the time of the Globe fire two months ago, and that of the Osgoodby building and several large warehouses a few days later, it was suggested, as a possible explanation, that electricity had, in some way, proven the primary cause of these fires. This suggestion is being offered with increased intensity as, not only a possible, but reasonable, explanation of the causes that led to the fire Sunday, March 3rd. Some of the daily papers have been very persistent in the effort to fix the cause of the fire in some way on the feed wires of the companies from whom power was obtained to light the Simpson building. The Onlooker would wish that every effort might be exercised to get at the bottom of this last fire, and also of the two previous ones. But don't let Mother Grundy take the place of common sense and fact. It has been said that the Simpson fire started in the basement where the feed wires came in. Let this statement be disposed of at once. The feed wires entered at the front of the building. The fire broke out in the rear. Another theory put forth is that possibly power from certain wires might be conveyed to a gas pipe and combustion take place there. The Onlooker has made careful enquiry on this point, and the unreserved opinion of experts who knew the building, and who are able to speak on a matter of this kind on general principles, say plainly that such a thing could not occur. An inquest on the Simpson fire is to be held without delay. The Onlooker sincerely trusts that it will result in an intelligent and satisfactory explanation of the trouble. It is hardly anticipating the finding of that body, however, to say that a multitude of absurd theories regarding the connection between electricity and the destruction of valuable property by fire will be thoroughly exploded.

It would be unwise to say that there is no risk whatever from fire in the use of electric lights. There are certain dangers. But compared with the use of gas, for example, not to say anything of less modern methods, these are infinitesimally small. The Onlooker has before him at this writing a statement showing that no less than 284 fires were caused in 1894 in London, Eng., by what is termed gas explosions, but not a single explosion produced by electric light. In a conversation with Mr. A. B. Smith, electrical inspector for the Underwriters' Association of Toronto, this fact was mentioned, and Mr. Smith believed, from his knowledge of the subject, and, perhaps, no one in Canada can speak more intelligently on this question, the *London* figures would be found to apply, relatively, to all other cities—a fact worth remembering when it is remarked that where fifteen years ago hardly a single commercial incandescent lamp was in existence, to-day 12,000,000 are used in the United States and Canada, and throughout the world there are nearly 25,000,000 incandescent and electric light circuits. The security and safety to be found in the incandescent system of lighting can readily be named. Matches are unnecessary. How many fires are constantly occurring through the careless disposition of the lighted match after it had been used to light a gas jet? As a covered light, there is no danger from the various inflammable oils, gases and dusts that are found in the air, and which, where the open gas jet is used, have frequently produced serious trouble. The one thing necessary to give the most perfect protection to incandescent lighting is care, experience, and perfect work in the construction and placing of the plant and wires. This department of work, Mr. Smith remarked to the Onlooker, had in the Dominion attained a very high degree of perfection.

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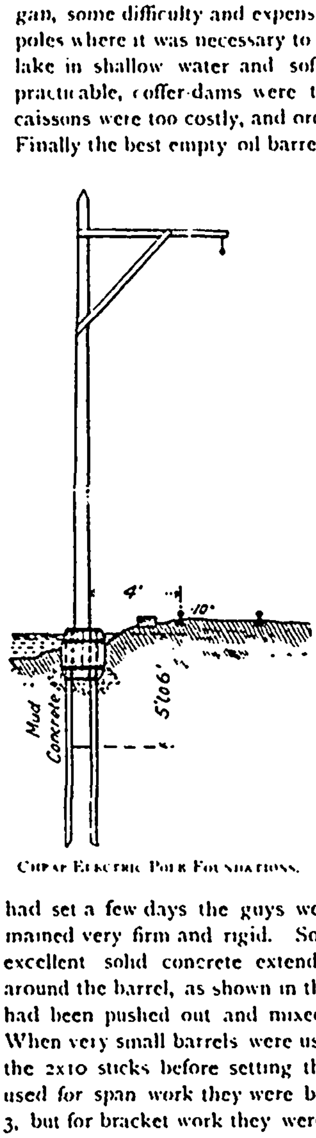
The Onlooker has had pointed out to him the danger that comes from the burning of the fusible cut-outs, thereby throwing out sufficient sparks to ignite any inflammable or combustible matter that might be near by, and the manager of a large concern in Toronto that instanced two cases of the kind. In the particular building named, Mr. Smith said some of the older methods of construction was still in use. At the present time fuses were protected in such a way by a plate that when they gave out the sparks were confined to the enclosure, and could not possibly do any harm. Saying this much, the Onlooker at the same time would not want to excuse *faulty construction*. The future of electricity as a method of lighting is going to rest in no small degree on the character of the work performed from this day out. A writer in the current number of the Engineering Magazine has said, perhaps no element among those which entered into the causes of fire and fire losses has caused more discussion and difference of opinion than electricity, since its introduction for light and power during the past decade. And this writer proceeds to show wherein certain dangers of fire will come from electricity. With the quarterly report of the Electrician for the Chicago Fire Underwriters' Association before him he discusses the result of fires alleged to have been caused by "grounds;" by the return current passing through the earth; a result of contact between conductors carrying electricity for light and power; and wires intended to carry only "battery" currents. Candidly admitting that fires have occurred in all these ways, and in other ways, he states the whole question when he says: "Anyone who cares to study the causes of fire started by electricity will be convinced that a very large portion of these fires are from defects, which would never have existed had the work of installation been done by men having a proper knowledge of the subject." In almost so many words this is the position taken by Mr. A. B. Smith, in his conversation with the Onlooker. Beyond any doubt, electricity is the coming method of lighting, alike for commercial and domestic purposes. The extent and rapidity of its growth will be retarded if such suggestions as come from Mr. Cabot, author of the article in the Engineering Magazine, from Mr. Smith, Mr. Rutherford, and other electrical experts are ignored. Contrariwise putting into practice the suggestions there made will give to this method of lighting full, complete and quick supremacy over all others.

Mr. C. F. Beauchim, of Montreal, is endeavoring to organize a telephone company in Quebec.

CHEAP ELECTRIC POLE FOUNDATIONS.

In the construction of the Negaunee and Ishpeming electric railroad and of the Marquette and Presque Isle road in Michigan, some difficulty and expense was anticipated in setting the poles where it was necessary to locate them in the edge of the lake in shallow water and soft mud. Pile driving was not practicable, coffer-dams were too troublesome and slow, iron caissons were too costly, and ordinary dredging was impossible. Finally the best empty oil barrels that could be procured were purchased, and after removing both heads were driven down solidly to about water level. Then the soft mud and clay was scooped out as much as possible and the pole set up on end in the barrel and worked down by hoisting and racking as far as it would go, usually 5 or 6 feet. A 2" x 10" stick was then driven with mauls each side of it, their flat sides against the pole and their bottom ends beveled to draw apart. When they were all in place the barrel was pretty well filled up by them. The pole was securely guyed and the mud again scooped out of the barrel and the water pumped down as low as possible, when about 30 pounds of dry cement was thrown in the bottom, and on top of that enough concrete, one-half small stone, was put in to fill up the barrel. After it had set a few days the guys were removed and the pole remained very firm and rigid. Some that were cut out showed excellent solid concrete extending nearly a foot below and around the barrel, as shown in the figure, when the dry cement had been pushed out and mixed with the surrounding sand. When very small barrels were used it was found better to drive the 2x10 sticks before setting the post. When the poles were used for span work they were battered excessively, up to 1 in 3, but for bracket work they were battered about 1 in 10. The cost was: Barrel, 60 cents; cement, 50 cents; lumber, 75 cents; labor setting barrel, 50 cents; driving posts, 40 cents; setting and concreting pole, 40 cents; total, $3.25. About 1 mile of poles were set thus in 1890, and are reported to have given complete satisfaction ever since. The above description has been prepared from the notes of Alexander Thompson, C. E., then resident engineer of the work, who devised the arrangement.—Engineering Record.



Cheap Electric Pole Foundations.

LOOK TO THE BOILER ROOM.

The enormous coal consumption per unit of output in many electric lighting and power plants is cause for general comment, especially since a recent committee report brought the wide variations of efficiency prominently into notice.

Theories innumerable are advanced to account for the difference between the fuel burned per horse-power in driving the dynamos, as compared with other service; a favorite conclusion seeming to be that compound engines are not satisfactory when working through other than narrow ranges of power variation.

While this is probably true of a great many of the engines used for such work where the cylinder proportions and general make-up are no credit to those responsible for the designs, yet there is little doubt but that one main cause of the trouble must be looked for in another direction. A glance through the power houses discloses the fact that many of them are run on an easy-going basis, no attempt seemingly being made to maintain proper discipline among the attendants, each of whom shifts for himself without let or hindrance from the directing authority.

A genuine fireman, thoroughly trained in the principles of his profession, would blush with shame at the sight of these boiler departments.

In place of clean grates, giving a bright glow beneath, the bars are masked by clinkers, and the ash pits yawn without a ray of light to show what is going on within.

The air wheezes as it forces a passage through the refuse, instead of passing in with that rustling sound that tells of free combustion.

At frequent intervals, between the discussion of politics, or other matter foreign to the work in hand, an individual, whose only claim to being a fireman lies in his ability to heave carbon against the back of the furnace, rises from an ottoman of coal and canvas, and throwing open a furnace door, leisurely proceeds to shovel in a half ton or so of fuel, after which work of art, with no attempt to level the fire, or clear the grate, he throws himself upon his couch for another restful season.

Under the too common management of such places, there seems to be not the slightest incentive offered a man to properly attend his boilers.

An enormous grate and heating surface, and immense chimney, are relied upon to maintain steam, when a few first-class men at the fires would make fewer boilers do better work.—American Machinest.

PERSONAL.

Mr. J. R. H. White has been appointed Secretary-Treasurer of the Montmorency Electric Light & Power Co., of Quebec.

Mr. Geo. A. Cox has been elected a director of the Toronto Railway Company to fill the place on the board made vacant by the resignation of Mr. J. W. Leonard.

Mr. Chas. A. E. Carr, the new manager of the London Street Railway, was a passenger on the Grand Trunk train which came into collision with a train going west from Toronto last month. Mr. Carr fortunately escaped uninjured.

Mr. J. W. Taylor, who has been manager of the Peterborough Carbon and Porcelain Co. since its organization, has resigned to accept the management of the Company recently organized at Ottawa to engage in the same line of manufacture. Mr. Taylor has already entered on the duties of his new position.

Mr. Frederic Nicholls, 2nd Vice-President and Managing Director of the Canadian General Electric Co., has been elected 1st Vice-President of the National Electric Light Association of the United States at the Convention recently held in Cleveland, Ohio. This international recognition of Mr. Nicholl's personal and business standing is the more pleasing in view of the fact that this will be his fifth year on the Executive Board of the Association, in which last year he filled the office of 2nd Vice-President.

Mr. J. P. Sparrow, for the last three years on the staff of the Canadian General Electric Co., as foreman of construction, has removed to New York, where he has been appointed to an important position on the staff of the Edison Illuminating Co. Mr. Sparrow, while in this country, has had charge of some important installations for the Canadian General Electric Co., such as the Niagara Falls Park & River Railway, the Brantford Street Railway and the power plant for the Dominion Government at the Canadian Sault.

A large number of the contemporaries of Mr. W. E. Davis, in the service of the Toronto Street Railway Company, on the eve of his departure for Detroit, to superintend the construction of the electrical system of the Detroit Railway Co., entertained him at a smoking concert at the St. Charles Restaurant, and presented him with a handsome gold watch, bearing the following inscription: "Presented to W. E. Davis by the employees of the electrical department of the Toronto Railway Company, in token of respect and esteem, on his retiring from the position of electrical engineer, Feb. 12, 1895." Mr. Thomas Graham, chief of the stores department, occupied the chair, and Mr. A. G. Horwood made the presentation. Mr. Davis was married a fortnight ago to Miss Meta Gallon, of Parkdale, Toronto. After the wedding breakfast a special car conveyed Mr. Davis and his bride to the Union Railway depot, where they embarked on a tour to Washington and Old Point Comfort.

Electric conduits made of small vitrified stoneware sewer pipe laid in concrete on brick subways have been introduced in England. The conductors employed are naked copper strips which rest on insulators, the pipes themselves, each two feet long, resting on porcelain bridges. In order to join the conductor with a house connection, a special length of pipe is furnished, which is U-shaped for a part of its length. The house lead is taken out through an insulated removable cover forming the top of this part of the pipe. The joints are made on the Doulton system, and require no cement.

SPARKS.

A semi-annual dividend of three per cent. has been declared by the Canadian General Electric Co.

Incorporation has been granted to the Mica Boiler Covering Co., of Toronto, with a capital stock of $50,000.

The number of telephone subscribers to the Windsor, Ont., exchange has increased in eight years from 54 to 800.

It is reported that the electric light is to be introduced at Eganville, Ont., by Messrs. John Childerhose & Sons.

The central station of the Victoria, B. C., Electric Light Co., was damaged by fire to the extent of $15,000 on the 26th February.

Negotiations are in progress with a view to the absorption of the St. John, N. B., Gas Light Co., by the St. John Street Railway Co.

The Hamilton Street Railway Company is said to have made an order forbidding employees from entering a saloon at any time.

Mr. D. C. Dewar has succeeded to the management of the Bell Telephone Company's Exchange at Ottawa, vice Mr. T. Ahearn resigned.

Application for incorporation has been made by the Milton Electric Light and Power Co., of Milton, Ont., with a capital stock of $15,000.

It is reported that an effort is being made to construct an electric street railway at Stratford, with radial lines extending out to neighboring villages.

A very successful "At Home" of the officers and members of the Canadian Marine Engineers' Association and their friends, was held in Toronto recently.

The annual meeting of shareholders of the Ontario Mutual Telegraph Company will be held at the company's offices in Montreal on the 28th instant.

The council of the town of St. Henri has granted permission to the Merchants' Telephone Co., to erect poles and string wires within the limits of the municipality.

The contract for carrying the mails between Hamilton and Bartonville, Stony Creek and Fruitland, has been secured by the Hamilton, Grimsby & Beamsville Railway.

The authority of the Ontario Legislature is asked to allow the Hamilton Iron and Steel Co. to construct a tramway to connect the works of the company with its quarry property.

The announcement is made that the exclusive rights and privileges of the Hull Electric Railway Co. have been purchased, on behalf of an Ontario syndicate, by Mr. Peter Ryan, of Toronto, and that construction will be commenced in the spring.

The London, Ont., Gas Co. has during the past year added machinery for the purpose of cheapening the production of gas, and is said to be about to make a big cut in price to meet the competition of the electric lighting.

It is reported that the first electric railway to be built in Muskoka, is being projected at Huntsville, and that it will span a difficult portage a mile in length, thus forming a connecting link in the navigation of the lakes of that vicinity.

Mr. C. G. Ballantyne, a native of Peel County, Ontario, has been granted an exclusive electric franchise for an electric railway in Honolulu, in recognition of services which he rendered the government in the recent battle with the rebels.

Incorporation has been applied for by the Peterboro' & Chemong Park Railway Co., with a capital stock of $100,000, to construct an electric railway from the town of Peterboro' to Chemong Park, and to any other points which may be thought desirable.

At the annual meeting of the Sarnia Gas & Electric Light Co., held recently, the old Board of Directors was re-appointed. The Directors at a subsequent meeting elected Mr. Thos Kenny as President, and Mr. Wm. Williams, as manager and secretary of the company.

Application is to be made to the Ontario Legislature to incorporate the Guelph Railway Co. to construct and operate a surface street railway in the city of Guelph, under the agreement entered into on the 7th of August last, between the corporation of Guelph and Mr. Geo. Sleeman. Power is also asked to extend the railway outside the city limits.

Mr. R. C. Cowan has been exhibiting in Montreal a snow sweeper, the invention of a Boston man named Callet. The sweeper can be operated by electricity or by horses, and by means of large brushes making 3,000 revolutions per minute, is said to be capable of perfectly cleaning the street of snow and dirt, which is carried by a Sturtevant blower through a funnel into carts.

At the annual meeting of the Guelph Light & Power Co. held recently, the annual report showed that notwithstanding the general depression, a fair business had been done. This applies also to the power distribution branch of the company's business. Mr. Guthrie, the president, stated that the success of the company is largely due to the careful and efficient management of Mr. John Yule. The old Board of Directors was re-elected.

A snow-brush for trolley cars, the invention of Mr R. G. Olmstead, of Hamilton, is said to have been successfully tested on the Hamilton, Grimsby and Beamsville electric road. It can be fastened to the front of an ordinary trolley car and will cost only about $150 each, whereas the large plows in use now cost over $6,000. The brushes are of steel and rest on each rail. They are geared from the axle but revolve four times as fast. There is also a small revolving fan underneath the car which prevents the snow banking up more than three inches between the rails.

The proposal made by one of the local papers that the town of Amherst, N.S., should purchase the plant of the Canada Electric Co., and operate the same, does not meet with favor. It is pointed out that in view of the necessity for a large expenditure in the near future for sewerage purposes, the town is not in a position to add the sum of $60,000 to its debt for the purpose mentioned.

The electric power houses at Ottawa have recently experienced much difficulty owing to the formation of anchor ice at the falls of the Chaudiere. The street railway company had great difficulty in keeping their cars running, and some of the streets were temporarily without light. This difficulty is experienced to some extent every year, but owing to the severity of the frost, is said to have been greater than usual the present winter.

The Hamilton, Valley City & Waterloo Railway Co., are applying for a charter. The capital stock is placed at $650,000, and the shares at $100 each. The promoters are The Rev. Dr. Burns, Messrs. John Hoodless, J. E. O'Reilly, A. McKay, M. P., F. A. Carpenter, Thomas Ramsay, James F. Smith, R. H. McKay, C. J. Myles, W. N. Myles, H. C. Fearman, Wm. Andrews, Guelph, Thomas Bain, M. P., Dundas, E. J. Powell, London.

A three days' Convention of agents of the Stanley Electric Manufacturing Co. was held last week at Pittsfield, Mass., the headquarters of the Company. The object was to have the agents look over the extensive plant in Pittsfield, and discuss and familiarize themselves with all questions and departments connected with the work. It is proposed to hold similar conventions once a year. Among those in attendance were W. S. Hine, J. B. Wallace and E. L. Barr, of Chicago, M. D. Barr and T. E. Theberth, of New York, Wm. H. Browne and J. A. Kammerer, of Montreal, Fred. P. Barnes of Boston and Wm. C. Whitner of S. C.

Mr. E. A. C. Pew, one of the leading promoters of the Lake Erie aqueduct project states that the canal will require to be only eight miles in length, connecting the upper part of the Welland River with the lower part of the Jordan river. The depth of the canal will be 23 feet. It is claimed that by means of this canal it will be possible to generate 300,000 h. p., half of which it is proposed to transmit for use in the city of Hamilton, and the other half to operate an electric railway from Toronto Junction to Bartonville, there connecting with the Hamilton, Grimsby and Beamsville road.

"The Niagara Falls and Lundy's Lane Street Railway Co., Limited," is seeking incorporation for the purpose of operating lines of street railway in the municipalities of the town of Niagara Falls, the village of Niagara Falls and the village of Stamford, and to connect with the Niagara Falls Park & River Railway Co.'s lines. The capital stock of the company is placed at $50,000. The promoters are:—Henry Charles Symmes, contractor; James Alfred Lowell, gentleman, Joseph Gibbons Cadham, clerk; Luther Richardson Symmes, mechanical engineer, all of Niagara Falls South; and Henry David Symmes of St. Catharines.

Tests have recently been made to ascertain the comparative efficiency of heating by electricity and by combustion. Masses of metals were heated to a red heat by combustion methods, and by electric current. In the first series of experiments a platinum rod was heated. The results showed that less than 5 per cent. of the thermal energy produced in the flame was transferred to the bar, whereas 90 per cent. of the electrical energy appeared as heat. In a second series of experiments an iron bar was used, and the result in the former case gave 75 per cent. of thermal energy transferred, and 88 per cent. in the latter case. These experiments show that for some purposes electrical energy has important claims.

The Ontario Legislature is asked to grant charters as follows. To Henry A. Everett, Edward W. Moore and Greene Puck, of Cleveland, Ohio, and T. H. Smallman, S. R. Brock and Charles H. Ivey, of London, as the London & Western Ontario Electric Railway Company; Hamilton Valley, City & Waterloo R.R.; Hamilton, Burlington & Lake Shore Electric R.R.; Brantford, Port Dover & Galt Radial Electric R.R.; St. Thomas Radial Electric R.R. Company; London & Springbank Electric R.R.; London Radial Electric R.R.; Toronto, Hamilton & Niagara Falls Electric R.R. Company; Georgian Bay Ship Canal & Power Co.; Hamilton & Lake Erie Power Co. The Stormont Electric Light & Power Company apply for an act to ratify and confirm a certain agreement. The Hamilton Radial Electric Railroad and the Hamilton & Dundas Street Railway Co. ask for amendments to their acts of incorporation.

The car barns and cars of the Halifax Street Railway Co. were burned a few days ago. The property destroyed was insured for $30,000 in favour of the Nova Scotia Power Co., who control the common stock. The Bank of British North America has garnisheed the insurance under a judgment which they hold against the Power Co. for $47,000. The opinion prevails that the railway will come under the control of the syndicate represented by Mr. Henry M. Whitney, which is at present seeking a charter from the legislature to operate an electric road on the streets of Halifax, as well as in other towns throughout the Province. The city council of Halifax has passed the following resolution in relating to this application. resolved, that with reference to the bill now before the legislature proposing to charter a company to construct and operate an electric railway in the streets of the city of Halifax, the city council hereby protests against the legislature granting the valuable franchises of the city of Halifax, unless provision is made in the act for fully remunerating the city therefor, such remuneration to be not less than five per cent of the gross earnings of the road, in addition to taxes, and that the road be constructed on such conditions as the city Council shall approve of.

ELECTRIC RAILWAY DEPARTMENT.

CENTRAL STATION TYPES.

NO. IV.

By Geo. White Fraser.

INTERURBAN ELECTRIC RAILWAY.

ELECTRICITY has a very great deal to contend against—violent enemies and injudicious friends. The writer had a man in his office one day, discussing a new method of propulson or traction, and in reply to a comment on one piece of mechanism, got the answer, "Well, I haven't thoroughly worked up that little point yet, and don't quite see my way to it, but I guess electricity will manage it somehow." And so electricity has to "manage it somehow" in all kinds of adverse conditions, against prejudice, ignorance, neglect and abuse. It says a great deal for the inherent vitality of electrical enterprises generally, that they are so popular, for it seems impossible to find a business which is less thoroughly understood and which is run with less educated intelligence. The conditions which contribute to the success of an electrical enterprise—commercial, practical, preliminary or operative—are completely lost sight of, if ever they did receive consideration, and we find small central stations in every part of Canada that actually "run" themselves, for all the attention that is given them from a business point of view. So long as the receipts are somewhat higher than the operating expenses the owners are satisfied, and the interior economy of the plant is not thought of, much less understood. It seems hard to understand why the shrewd business methods that achieve success in other branches of manufacture, should not be applied to the production of electric current, and in the management of enterprises involving its use. The object of all the machinery and apparatus in a lighting station being the incandescence of the little 25c bulb, what percentage of the men who are responsible for the business management of such stations know anything of the commercial conditions under which that bulb will produce the best dividend? How many of them study "lighting" from a broad standpoint, as a legitimate business? There are very few stations where it can be said that a pound of coal at the boiler door, can be traced through its various changes, until it finally bursts out into light in the lamp, and that every heat unit can be accounted for. Until this can be done, the station must be said to run itself, and all claims of strict economy are worth nothing, for it is only by means of watching this pound of fuel throughout its course that its performance can really be checked and its little delinquencies remedied.

If careful scrutiny and the most rigid application of business principles are important in electric lighting enterprises, they can truly be said to be the very life of an electric transportation business. An enterprise having for its object the transportation of large numbers of passengers and quantities of freight, involves the consideration of so many main and side issues, so many commercial as well as practical questions, that as a rule we might expect better results to be worked out in such a case, than in one when it is simply a question of light. The necessity for the careful consideration of such matters as route, rights of way, terms of franchises, contracts for freighting and such purely commercial questions, would seem naturally to lead to a more thorough investigation into, and therefore a much better and more comprehensive grasp of the purely practical features of the transportation. In fact, in the latter class of enterprise, "transportation" is recognized to be the aim and object, and the broad principles underlying the successful prosecution of such a business are more thoroughly understood, "electricity" being properly regarded as a means only, whereas, in the former class, this generalization is not made; there is no study of the broad, fundamental principles of "lighting," and consequently, not the same success. In this connection it is a somewhat significant fact that, although cases are not infrequent, of electric light enterprises earning no dividends, we do not hear of electric railways failing of success in that respect—the reason being that one set of enterprises is managed on business principles, whilst the other is not.

While electricity seems to offer a better solution of the various practical problems encountered in the working out of an urban, or interurban, transportation scheme, neither electricity nor any other force can make business, the possibility of which must be pre-existent; and a very instructive example of how such a business may be worked up is afforded by the Galt & Preston Street Railway Co., using electricity in connection with a steam dummy as its motive power.

This railway runs between the towns of Galt and Preston, a distance of a little over four miles, and is going to be extended to Hespeler, another stretch of about four miles. The power house, being at Preston, will thus be at about the centre of the track. The C. P. R. runs through Galt, and the G. T. R. has stations at Galt, Preston and Hespeler. At Preston are situated several flourishing businesses: furniture factories, foundries, woollen mills, grist mills, &c.; and in Galt are the best educational establishments and high class stores of the surrounding country. The fact that the C. P. Ry. does not touch Preston was at once taken advantage of by the directors of the Electric Railway Co., who arranged to afford to Preston a competitive outlet by running in connection with the C. P. R. themselves. Goods can be booked at any station on the C. P. R. to or from Preston, and between Galt and the latter place are handled, in the C. P. R. cars, by the G. & P. railway, who use for this purpose a steam dummy engine. An amount of freight averaging 110 tons a month, is handled in this way in direct competition with the G. T. Railway; the advantage to consumers being that the G. & P. Railway has switch tracks right into its patrons' yards, whereas the Grand Trunk deposits goods at its own depot. A special attempt was made to induce business by getting the large factory men in both termini interested in the road, and with great and evident advantage. Here then is a good foundation for dividends. Special inducements are held out to capture certain classes of business: school tickets at greatly reduced rates are sold to scholars, and special arrangements made for their comfort. Commutation tickets are also sold, either for local use in Galt only, or for use between termini. A special feature is the freighting business for lighter packages. Two cars only are run on this road, one of which is a double-truck, 40 foot car, divided into compartments, one for passengers and the other for small freight. This question of small freight is one of particular interest in all interurban railways, which may not be so favorably situated as is the G. & P. Railway Co., with respect to railway co operation. It is a class of business that is capable of very considerable extension under enterprising management, and productive of great profit.

The accounting department, which is in the hands of Mr. W. H. Lutz, the Secretary of the Company, is so managed that any disbursement can be at once traced to its cause, and, by the voucher system, is without any difficulty debited under its proper heading, whether "operation," "maintenance," or other. The practical part of the electric system is under the superintendence of Mr. A. Lea, who is well qualified to care for it, by both technical knowledge and actual experience. It was originally proposed by a gentleman interested in the undertaking to do without an electrical superintendent, for the sake of economy, and to let the "electrician" of the local arc plant take a "look over the machinery now and again." The company is greatly to be congratulated on having escaped this peril. That sort of economy is what generally results in a beautiful scrap heap.

The practical features of this enterprise are just as admirable as its business arrangement. The track is 56 lb. Tee. rails, laid to a gauge of 4 ft. 8½ in.; placed on ties, spaced 2 ft. centre to centre, with 8 in. face. It is single bonded, with, I believe, no supplementary return. The route is in general undulating, with slight curves and grades; one 100 ft. curve being on a 5% grade 1200 feet long. A No. 0000 (four o) feeder runs along the track and is tapped to the trolley wire every five or six poles. The power house itself is very compactly laid out, containing two boilers, two compound Wheelock engines, so arranged on the same shaft that they may be clutched together; and as yet, one Westinghouse 175 ampere generator. The two cars have each two 30 H.P. Westinghouse motors, mounted on Taylor trucks with cars built by the Ottawa Car Co., and heated by electric heaters. The series parallel controller is used. The engines are each rated at 130 H.P. The proper and economical proportioning of the various parts of a power house is always a more difficult matter with a small plant or road than with a large one, and a much greater margin must be allowed in a small one. Thus the proportioning in this plant—130 H.P. steam, 117 H.P. generator and 120 H.P. in motors, is probably as good as any with only two cars, which may both be starting on a grade at once. Especially is this so in summer, when a load of 240 persons has been carried on one motor car and a trailer. On a road running a greater number of cars, a much greater economy could be effected at equal efficiency.

The steam plant is, so arranged that the feed water from the hot well is heated by the exhaust steam from the low pressure cylinder, on its way to the condenser. It is run into the hot well from the condenser at a temperature of about 90°, and is raised to about 112° in the heater.

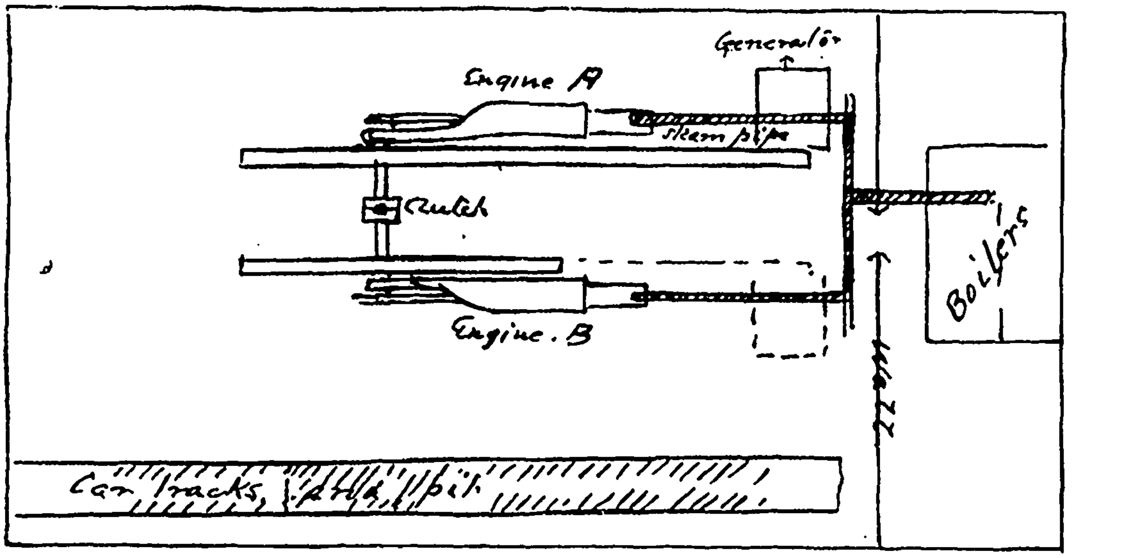
The two cars are housed right in the power house—a track (with pit) having been run up along one side of the engine room, but it is the intention of the Company to build a regular car barn when their extension is completed.

The two cars are served by three sets of conductors and motormen; motor and overhead repairs being done by the set that is "off," who are paid extra for this service. One trackman is constantly employed on the rails, &c.

This road has not been running long enough to arrive at any satisfactory figures as to the cost of running per car mile, for maintenance, fuel, &c., or to give the results of experience with its various kinds of apparatus; but under its very capable business and practical management, no doubt these figures will work out well in comparison with data obtained from larger and more established roads.

It is greatly to be regretted that, even in this otherwise satisfactory plant, injudicious prelimininary design should be able to affect subsequent working. The general disposition of the boilers, engines and dynamos will, by reference to the diagram, be seen to be such as to necessitate much more piping than good design would call for, as well as a very clumsy method of changing the generator from one engine to the other.

Belting back from the engine to the generator has the effect of pushing the latter away into a corner, while the piping is unnecessarily lengthened, with all the consequent loss in fall of pressure, condensation, &c. There is plenty of room to belt forward, and the cylinders might then have been almost against the boiler room wall. And the method of changing engines is humorous in its simplicity. In order to run the generator off engine B, it is necessary to stop engine A, close the clutch by dropping a pin in the hole indicated, take off the connecting rod of engine A entirely, and then start up B, which thus has to run not only the generator but also A's flywheel. The fall in pressure between the boiler and the high pressure cylinder is 9 lbs., due entirely to this injudicious design.



The Mattawa Electric Light and Power Co. are applying for power to increase their capital stock to $30,000.

SPARKS.

There is a rumor to the effect that it is the intention of the C. P. R Co. to utilize the power at Keewatin to operate by electricity their trains beteen Port Arthur and Moosejaw.

Messrs. Thos. Elliott, C. H. Waterous and others are applying for a charter to build radial electric railways from Brantford, Ont., to Paris, Galt, Simcoe, Port Dover and other places

Mr. J. M. Campbell, manager of the Kingston Electric Light Co., is said to be one of the principal promoters of the proposed Kingston and Gananoque electric railway. It is said to be Mr. Campbell's intention to reside at Gananoque in the future.

The Hamilton Street Railway Company has hit upon a method of increasing traffic during the winter season, corresponding to the attraction of suburban parks in summer. With the object of attracting crowds of skaters to the bay, the company keep clear of snow a wide strip of ice, which is illuminated by the rays of a search light mounted on the roof of the power house.

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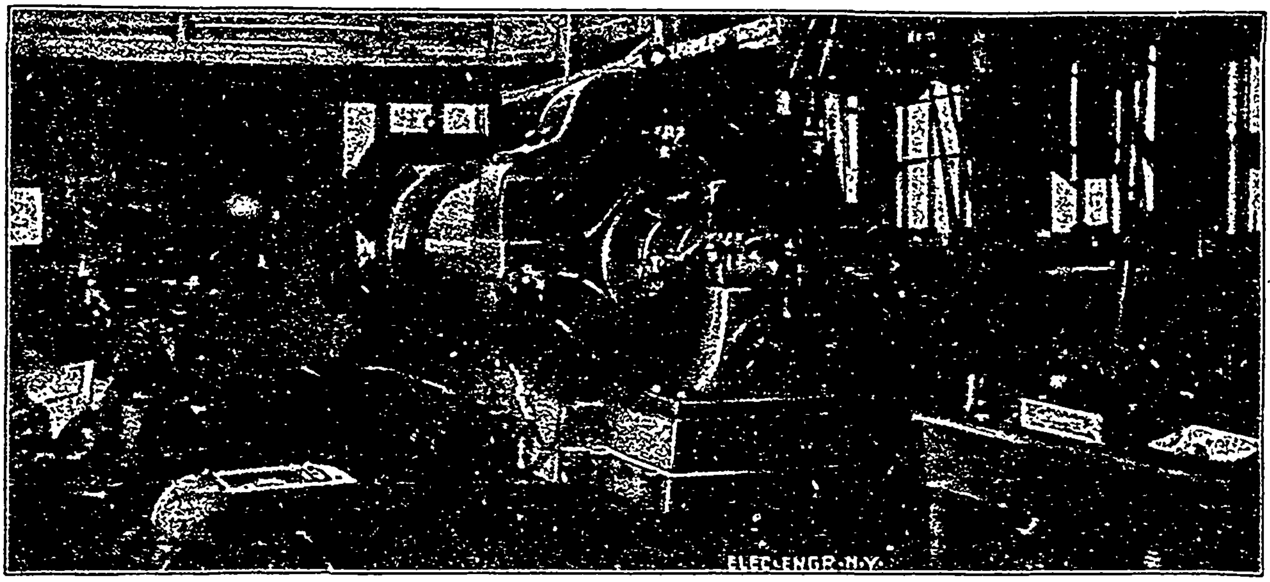

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SPARKS.

A charter of incorporation is being applied for by the Ingersoll Electric Light & Power Co., of Ingersoll, Ont.

A very enjoyable sleighing party was held by the night staff of the Bell Telephone Co. Toronto, on the 12th of February.

The electric welding machine recently installed in Gillies' Carriage Factory at Gananoque, by the General Electric Co., is said to be giving good satisfaction.

The electric lighting plant at Hespeler, Ont., has been purchased by a Mr. Skinner. The purchaser has not decided whether to operate the plant or remove it.

Application for incorporation is to be made for the Hamilton Storage Battery Co., Limited, with a capital stock of $10,000. The applicants are Dr. Stark, Dr. Osborne, W. D. Long, G. H. Bisby, Geo. Lowe, Jos. Farrell and H. E. Copp.

The earnings of the Toronto Street Railway Co. for February were $62,000, working expenses 59 per cent. or 10 per cent. less than during the same month last year. The net earnings for the month showed an increase of $7,200 above those of February, 1894.

Petitions are being circulated in Stratford, asking the council not to enter into a five years' agreement for electric street lighting, with the Stratford Gas & Electric Lighting Co., until the price of gas is reduced, or until tenders have been received for the lighting franchise.

The Winnipeg Electric Railway Company have distributed along their lines old horse cars fitted up with stoves and otherwise made comfortable as waiting rooms. In such a climate as that of Manitoba, such a provision will doubtless be appreciated at its true value by passengers.

A report of the city electric inspector of Victoria, B. C., shows that it cost the municipality last year $97.95 per annum for each arc light, running five and one quarter hours per day. It is claimed that when the improvements which are now being made to the plant are completed, the cost will be reduced to $80.00 per lamp per year, including interest and sinking fund. The municipality operate 300 arc lamps.

The City Engineer of Toronto, has recommended that under the requirements of clause 38, of the agreement between the Toronto Railway Co. and the City, the carrying capacity of ordinary closed cars be limited to fifty per cent. above their seating capacity (allowing a space of 18 inches on the seat for each person) and that open cars be limited to their seating capacity. He further recommends that in order to avoid disputes, a notice should be posted in each car, stating the exact number of passengers it is allowed to carry.

A number of Ottawa men are said to be endeavoring to secure control of a tramway line at Kingston, Jamica. The line is at present operated with mules, and extends through the city and seven miles outside to a large hotel which was erected at the time of the Jamaica exhibition, and which is said to have proved a very successful enterprise. Mr. C. Berkeley Powell has gone to Jamaica on behalf of the Ottawa syndicate to see what can be done. It is understood to be the intention to substitute electricity for animal power, should the syndicate get control of the present line, the franchise for which expires in October next, and endeavor to secure a franchise for a new line, if the present one cannot be got, also to construct electric roads to supply communication between the sugar plantations on the island.

The series of moonlight tables for 1895, now appearing in the ELECTRICAL NEWS were compiled by the Cleveland Carbon Co., Cleveland, Ohio.

Notice is given that application will be made by the Hamilton Radial Electric Railway Company to the Legislature of Ontario for an Act to amend the Act of incorporation, by providing that the said company shall have authority to operate the Guelph and Berlin branches of the said railway by steam as well as by electric power and increasing the bonding powers of the company in respect of such portions of the said railway as may be constructed for operation by steam power.

At a recent meeting of the Hubbell Primary Battery Co., of the organization of which at Ottawa, mention was made in a recent number of the ELECTRICAL NEWS, the following gentlemen were elected directors of the company:—Messrs. J. W. McRae, Dr. A. A. Henderson, N. C. Sparks, H. B. Spencer, Archie Stewart, J. R. Trudeau, S. M. Rogers and E. F. Hubbell. At a subsequent meeting of the directors, Dr. Henderson was elected president, F. C. Sparks, vice-president, and E. F. Hubbell, secretary-treasurer. Satisfactory tests of the Hubbell Battery are said to have been made, and the directors express their intention of proceeding immediately with its manufacture.

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