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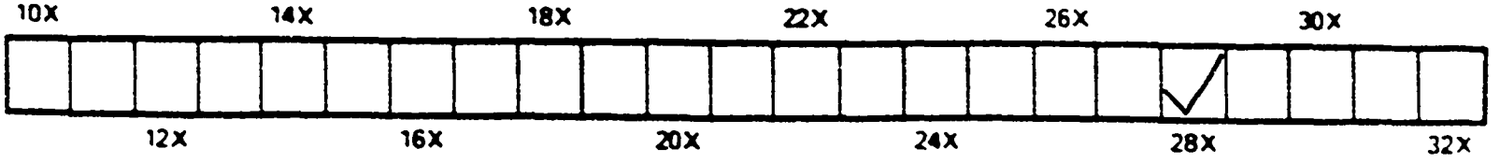

CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 5.
NEW SERIES, VOL. IV.—No. 7.

JULY, 1894

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CANADIAN

ELECTRICAL NEWS

AND

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VOL. IV. JULY, 1894 No. 7.

THOMAS A. EDISON.

We present as a frontispiece to this number of the ELECTRICAL NEWS an excellent portrait of Thomas A Edison, the famous electrical discoverer and inventor. Mr Edison, who is of Dutch extraction, was born in Erie County, Ohio, 46 years ago. Owing to reverses which overtook his family, he was at an early age obliged to seek his own living. He began his business career as a newsboy on the Grand Trunk railway and while thus employed commenced studying and experimenting in chemistry. At seventeen years of age he is said to have become one of the most expert telegraphers on the railroad The history of his greatest achievement, the incandescent electric lamp, and the legal battles which he has had to fight to maintain his rights as the inventor, will be fresh in the minds of our readers. The inventive character of Mr. Edison's mind can be judged by the fact that he has been granted no less than 720 patents, while in addition he has 150 applications on file.

THE BEST RESISTANCE FOR THE RECEIVING INSTRUMENT ON A LEAKY TELEGRAPH LINE.*

By Prof W E. Ayrton, F. R. S., and C. S. Whitehead, M. A.

1 If there be a single earth fault at any one point of an otherwise good telegraph line, P Q (Fig. 1), it is easy to prove that the best resistance to give the receiving instrument at either end of the line is equal to the apparent resistance of the line tested from *that* end when put to the earth at the other end through a resistance equal to that of the signalling battery at that end. For example, if we desire to know what should be the value of q, the

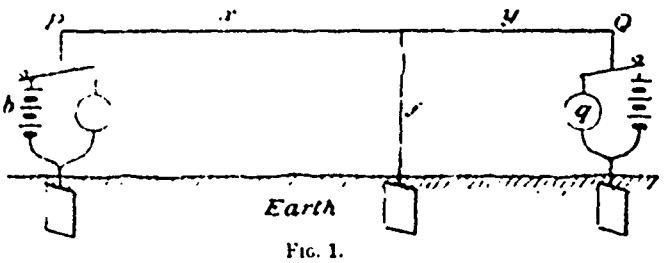


Fig. 1.

resistance of the receiving instrument at the Q end, the line must be tested from the Q end (Fig. 2) when put to the earth at the P end through a resistance, b, equal to that of the signalling battery usually employed at that end.

And the magnetic effect produced by an electro-magnet of given size, shape, and construction is proportional to the product of the current into the square root of the resistance of the wire with which the coil is wound. Therefore it follows that the magnetic effect of the receiving instrument at Q is proportional to $A \sqrt{q}$, and this has a maximum when q is equal to the apparent resistance of the line tested from the Q end and put to earth at the P end through a resistance b.

2. During the course of some lectures at the Guilds Central Technical College last year on faults on telegraph lines, the question arose whether the above result was universally true for a distributed leak all along the line, or only for a single earth fault; and, if this solution were not generally true, then what was the best resistance to give to the receiving instrument at the end of a telegraph line the leakage along which followed any law. The complete solution of this question shows that when the line is uniformly leaky the receiving instrument ought to have a resistance equal to the apparent resistance of the line when tested at the receiving end and put direct to earth at the sending end.

The resistance of the signalling battery does not in this case appear in the best value to give to q, but that arises from the fact that, whereas when we are dealing with a single earth fault we assume that the signalling battery had a fixed E. M. F. and a fixed resistance, here we have assumed that the potential of the

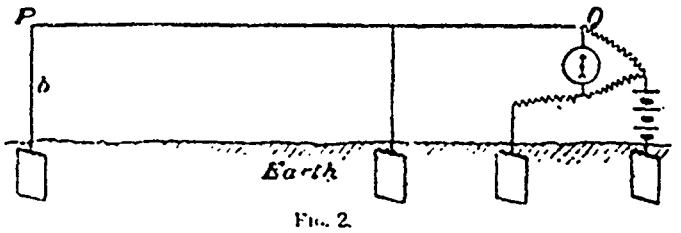


Fig. 2.

sending end of the line, was kept constant. Now this is the same thing as supposing that the signalling battery of fixed E. M. F. has an extremely low internal resistance. The two results are therefore the same.

If the distributed leak follow *any* law, the general differential equation cannot be integrated, and we must deal with the problem of determining the best resistance to give to the receiving instrument at the end of the leaky telegraph line without actually integrating equation, and withought expressing in an explicit form the value of the current that passes through the receiving instrument. The Paper shows by an elaborate mathematical calculation that, whatever be the nature of a leak on a telegraph line whether the leak be a single one, or be distributed along the line according to any law of distribution the same rule holds true for the best resistance to give the receiving instrument, viz., the receiving instrument at either end should have a resistance equal to the apparent resistance of the line when tested from that end and put direct to earth at other end.

* Abstract of a Paper read before the Institute of Electrical Engineers.

THE HAMILTON PUMPING ENGINES.

Hamilton, Ont., June 14th, 1894.

Editor Electrical News.

Sir,—There has been a great deal said of late about the Hamilton pumping engines. I took a trip to see them, and think the less said about them the better. They look as though they had been at war with something. If they have not broken down what have all the iron straps been put on them for? As for the test, like many another made in this city, it was of a kind which any capable man should be ashamed to have anything to do with. Can any one point me to a first class engine made in Hamilton in twenty years, with one exception? I know there has been a great deal said in favor of the engines made and sold here, but if one of them should be loaded to its rated capacity, there would be witnessed lots of fun. We expect to see a first-class engine turned out of Hamilton in a few days. In the meantime let us have a rest from the Hamilton pumps. What with pumps, engines, parks and mountain, we are a laughing stock for the country.

Yours truly,

"Oil. Can."

MOONLIGHT SCHEDULE FOR JULY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	
1.....	P. M. 7.50	A. M. 3.40	7.50
2.....	" 7.50	" 3.40	7.50
3.....	" 7.50	" 3.40	7.50
4.....	" 7 50	" 3.40	7.50
5.....	" 7.50	" 3.40	7.50
6.....	" 7.50	" 3.40	7.50
7.....	" 8.50	" 3.40	6.50
8.....	" 9.50	" 3.40	5.50
9.....	" 10.20	" 3.40	5
10.....	" 11.00	" 3.40	4.
11.....	" 11.30	.....	
12.....	.....	" 3.40	4.10
13.....	A. M. 12.30	" 3.50	3.20
14.....	" 1.00	" 3.50	2.50
15.....	" 1.40	" 3.50	2.10
16.....	No light.	No light.	....
17.....	No light.	No light.	....
18.....	No light.	No light.	...
19.....	P. M. 7.40	P. M. 10.10	2.30
20.....	" 7.40	" 10.40	3.00
21.....	" 7.40	" 11.00	3.20
22.....	" 7.40	" 11.30	3.50
23.....	" 7.40	" 12.00	4.20
24.....	" 7.40	A. M. 12.20	4.40
25.....	" 7.40	" 12.50	5.10
26.....	" 7.40	" 1.10	5.30
27.....	" 7.40	" 1.30	5.50
28.....	" 7.30	" 2.20	6.50
29.....	" 7.30	" 3.20	7.50
30.....	" 7.30	" 4.00	8.30
31.....	" 7.30	" 4.00	8.30
		Total,	152.00

CAUSES OF EXPLOSIONS.

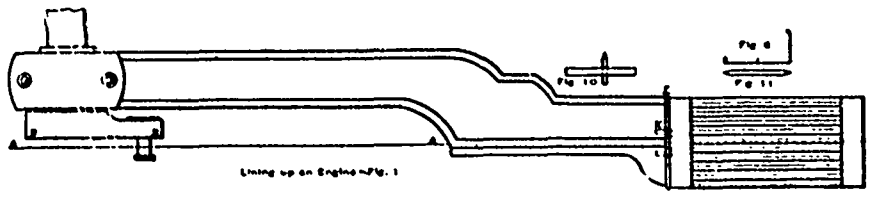
The causes of explosions may be summed up in one sentence, namely, lack of strength to withstand the pressure. This want of strength may be due to faulty construction, but as a rule it is due to some acquired weakness, unknown simply because unlooked for. Weakness results from unequal heating, which produces unequal expansion, from corrosion, improper setting, scale, low water and want of circulation. It may not always be possible to avoid unequal heating, as for example, in getting up steam many boilers will be hotter in some parts than in others, but scale can be prevented by "boiler compounds," and low water by a little care. In some types of boilers no provision is made for water circulation, and unequal heating is bound to occur. A thorough inspection from time to time will inform the engineer if his boiler is weakened by it, but the best plan is to use some other type. To sum up, the engineer must understand and act upon the motto, "eternal vigilance is the price of safety."—Safety-Valve.

The receipts of the Montreal Street Railway for May were the largest since the adoption of the electrical system, amounting to $85,000, an increase of $25,000 over the corresponding month of last year.

LINING UP AN ENGINE.

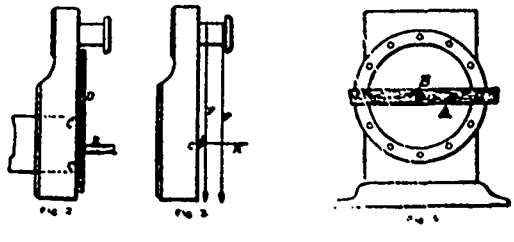
By W. E. Crank.

Engineers are often bothered by the pounding of their engines, and as pounding can be heard by everyone in the neighborhood, it is very annoying. There are many things that cause pounding, so that in some engines the cure of it is quite a complex subject. Being out of line is the general cause. Either the shaft is not in line with the cylinder, or the crank pin is not put in straight, or something else of the kind is the matter. A high speed engine perfectly in line will be very apt to pound with a light load, unless there is considerable depression, owing to the heaviest thrust coming on the end instead



of the commencement of the stroke. The thrust is caused by the momentum of the moving parts. To ascertain if an engine is in line, the back cylinder head should be taken off, the piston, piston rod, and cross head should be taken out of the way, and a line A A, Fig. 1, should be put through the cylinder and extended beyond the crank. To hold this line in the cylinder we take a strip of board, A, Fig. 4, and bore a couple of holes to fit over two of the studs at the end of the cylinder, and in the center of the board we bore a larger hole, say 1½ or 1¾ inches in diameter, and attach the cord to a little stick B, that stretches across the hole. The strain on the cord will hold this in position, and it can be readily shifted.

In front of the crank set up an upright, A A, Fig. 5, with a hole in it and a stick B across it. The hole should be in line with the middle of the crank pin. The cord used for this purpose should be strong and small, and should be made of something that will stretch perfectly straight. A silk hair line, such as is used by fishermen for fly fishing, is the best. Some men use annealed wire, but wire gets hard and stiff, and kinks get in it which can never be perfectly straightened, and one of these kinks is very apt to come where you want a perfectly straight line. Wire is not recommended. Be sure that the stuffing box K, Fig. 1, is perfectly clean. Attach one end of the cord to the stick B, Fig. 4, and the other end to the other stick. The cord should then be drawn so tight as to be perfectly straight. It can be tightened by turning the stick B over and over. To center the string cut a stick a trifle over one-half the diameter of the cylinder in length, and try the cord in

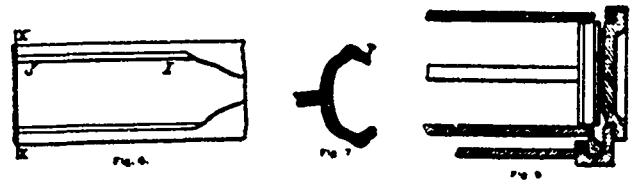


the end of the cylinder, cutting off the caliper stick as occasion requires, until the cord is exactly in the center of the cylinder. Then get a shorter stick and try in the stuffing box, moving the end of the cord that is beyond the crank until the cord is centered in the stuffing box. Then go to the back end of the cylinder and try that again, and so on from one to the other until the line is exactly in the center in both ends of the cylinder. There is now a line to work from to bring everything straight with the cylinder.

The first thing is to find out if the guides are in line. Take a stick (Fig. 10) with one side straight. Bore a small hole in it and put in a second stick, as shown in the cut so that it will be held snugly but will still be loose enough to be easily moved. Set this stick against the edge of the guides at I and J, Fig. 6, and move the small stick up to just touch the line. The end of this stick should be sharpened so as to bring a small surface to the line. If the guides are in line, the stick should just touch the line when tried at both ends. If they are not in line it will touch the line at only one end. If that is the case there is but one remedy, and that is to swing the cylinder around and put in strips of brass at L, Fig. 1, as this is the place that the guides are usually out. This is quite a job and requires some time and considerable patience. It is occasionally necessary to shim the cylinder up on the other side. The line will now have to be set over again until it is once more straight with the cylinder and guides. Fig. 7 is a cross section of the guides through the line XX, Fig. 6. A plumb line suspended from point P will tell if the guides are perpendicular. If not, the bed should be swung over, or around, until they are. In case this cannot be done, either the cross-head will have to be changed in the shoes, or the shoes themselves changed so as to run straight in the guides, and at the same time bring the cross-head pin level. Knowing the style of cross-head it would be easy to tell how to do this. It is a very good test for an engineer's judgment.

The next thing to consider is the crank. Cut a small stick that will just fit into the crank, and mark a line across the center. Bring the crank pin up under the line till it touches, and note whether the line crosses the mark on the stick, or how much of it is out, and then turn the crank around and bring the pin up under the line on the other side. Note how much it is out on that side, and if out, whether it is on the same side of the mark as before, or on the opposite. If on the side, it shows that the center of the pin is not in line with the cylinder, and the shaft must be shoved endwise until the line crosses it at the middle. If the construction of the engine will not allow this with the means at hand, take off from the side of the crank-pin boxes the amount that the line shows that it is out. Then fit pieces of brass on the other side of the crank-pin boxes to make up what has been taken off. If the boxes can be recessed for these pieces, all the better; but if not, they can be fastened in with pins. If the line is on one side of the mark when the crank is on the center, and on the other side when on the other center, it shows that the shaft is not square with the cylinder, in which case the outer end of the shaft should be swung around to bring it straight with the line. If it should happen that the shaft could not be moved at that time, the distance that it must be moved can be calculated, and then it can be done any time afterwards.

Suppose that Fig. 8 is a shaft and crank. It is plain that as the distance from the angle to 1, in either direction, is the same, moving one of these points a certain distance will move the other one the same distance; but if we double the distance to one of them, carrying us to 2, then we should move 2 twice the distance that we should 1; so that to find the distance we should move the end of the shaft we must divide the length of the shaft up to the outer pillar block by the length of the crank (not the length of the stroke), and multiply the result by the distance that the line is out from the mark on the pin. For instance, if the mark on the pin is out 1-16, the shaft 2½ feet long, and the crank one foot long, we multiply the 1-16 by 2½, which makes 5-32 that the outside pillar must be moved. To find if the shaft is level, place the crank upright and suspend the plumb line down over the end of the pin, and then turn the crank down and note how much it is out. A similar calculation will give the amount the end of the shaft must be raised or lowered. To determine if the crank pin is straight with the shaft would be an easy matter if the face of the crank was flat; but as a general thing, when the shaft is finished it is left uneven, as can be seen by putting on a steel straight edge. Even if the face is flat it is possible that it is not square with the shaft. To determine, then, if the pin and shaft are parallel take two thin blocks C C, Fig. 2, and a straight edge D, and hold them in position by the stick E placed against any handy support. The blocks C C should be placed against the end of the shaft the same distance from the center. The straight-edge D will then be at right angles to the shaft, and a square placed against the face of it and against the pin will show if the pin is straight one way. To determine if it is straight the other way, place the blocks C C and the straight-edge D in a horizontal position, suspend two plumb lines, F F, over the pin, as shown in Fig. 3, and run the square H along the straight-edge to the lines, when it should touch both lines. Should



the pin become loose in the hole, and it be necessary to bore out the hole before putting in another pin, the boring can be set in the same way.

It should be remembered that a crank-pin wears only on one side, and also that, if it has been out of line, one end may be worn more than the other. This can be ascertained by calipering, and if the pin is not straight the difference must be allowed for, according to the circumstances of the case in hand. When the brasses have been babitted, there will be a small ring on each end of the pin that will not be worn. Pounding is sometimes caused by the piston running over the ports, as shown in Fig. 9. The piston may then be thrown to one side, or raised up from the bottom, even when the steam enters the top. When such is the case, nothing can be done except to make the piston fit the cylinder as well as possible. Fig. 11 is a caliper stick for setting the line, and can be whittled out of any handy piece of pine.

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TORONTO—A. E. Edkins, A. M. Wickens, E. J. Phillips, F. Donaldson.
HAMILTON—P. Stott, R. Mackie, R. Dickinson.
PETERBORO'—S. Potter, care General Electric Co.
BRANTFORD—A. Ames, care Patterson & Sons.
KINGSTON—J. Devlin (Chief Engineer Penetentiary), J. Campbell.
LONDON—F. Mitchell.

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

THE thirteenth annual meeting of Railway Superintendents of Telegraph of the United States and Canada assembled in Detroit on June 13th. A number of interesting papers were included in the programme. It was decided to hold the next convention in Montreal on June 14th, 1895.

PRINTERS' Ink compares an advertisement to an electric current. The newspaper is the switchboard. The advertisement is the operator. When the advertiser would electrify the public he manipulates the switchboard, and the powerful current which he so thoroughly controls enlivens the community and often shocks or even kills a competitor.

SOME gentlemen at Rat Portage recently solicited from managers of electric lighting companies throughout Canada, details of cost, etc., of operation of central stations. The request was accompanied by the promise that to those who responded favorably to the request for information, a copy of the statistics thus gathered and to be compiled would be furnished. The parties interested are enquiring why this promise has not been fulfilled.

A REPRESENTATIVE of THE ELECTRICAL NEWS who recently visited Iroquois, Ont., was surprised to find the town enveloped in darkness after nightfall. He was still more surprised to learn that there is lying idle in the town a complete electric lighting equipment. The town's financial condition not being as favorable as could be desired, the Council have been cutting down expenses, and have refused to spend the money sufficient to light the streets. The lighting company have offered to supply ten 2000 c. p. arc lamps at the exceedingly low price of $40 per lamp per year. It is very doubtful economy to rob the town of its attractiveness and the citizens of their comfort for the purpose of effecting so small a saving. This is the view of a majority of the taxpayers. This case serves to illustrate what a pleasant and profitable business it sometimes is to supply electric light to municipalities.

THE Dominion Government will be asked to make a grant of money towards defraying the cost of a Dominion Exhibition in Toronto in 1895. The so-called Dominion Exhibitions which have been held in the past have not even in a moderate degree been representative of Canadian progress. An Exhibition which should be truly Dominion in character would be likely to result in adding to the population and business of the country. Something of the kind is needed at the present stage in our history, and we therefore hope the Federal and Provincial Governments will liberally assist the Toronto Board of Trade, the Industrial Exhibition Association and others interested, in bringing the project to a successful issue.

THE effort of a company to secure the passage of a Bill through the Dominion Parliament giving them the right to construct an elevated railway through certain of the principal streets of Montreal, was nullified by the determined opposition of the citizens. The Bill, as it passed the House, provides that before construction shall begin, compensation shall be made to the owners of property which would be damaged in value by the carrying out of the enterprise. This provision of the Bill will it is believed be sufficient to stop the further progress of the scheme. In a city of compact area like Montreal, there does not appear to exist the slightest necessity for an elevated street railroad. The electric street cars answer all the requirements, and in placing property owners beyond the reach of possible blackmail, Parliament has done an act of simple justice. There has been too much juggling with public franchises of late in the city of Montreal.

AMONGST the necessaries of life the telephone has taken its place, and as such it is interesting to compare its cost to the user in different countries. In Austria-Hungary, where the state telephones cover the whole country outside of Vienna, there is an installation charge of $25 and an annual rental of $25 more. Switzerland has gradually reduced the charge until now it is about $16 per annum. In France, telephones are managed by the state, and the charges are $40 for towns with over 25,000 inhabitants, and $30 for smaller towns. In Italy, for ordinary sized towns, the cost is from $25 to $30. In Sweden, where the telephone is very generally used, there is an extensive system of state telephones charging $22, whilst in the smaller towns the rates of private local companies are as low as $8. In Norway the cost varies according to the size of the town, from $11 to $12, and in Spain from $15 to $55. Holland has a Bell Telephone Co. which almost monopolizes the business, and the cost ranges from $50 in the large towns to $25 in those of about 30,000 inhabitants, and to $20 in still smaller towns. In Belgium the charges are from $25 to $30. In Denmark the Copenhagen Telephone Co., which connects by telephone cable with the Swedish system, charges $41 annual subscription. In the provincial towns the cost varies from $7.50 to $21. Finally, in England a telephone in London costs $100 annually, and in other towns from $40 to $50. In comparison with these prices we in Canada have nothing to complain of with $45 per annum for an office telephone and $25 for a house telephone in a city the size of Toronto.

THE project of a wire rope tramway across the Niagara gorge, which sought incorporation this session at Ottawa, draws attention to the increase of late years in the use of this method of transportation, which after suffering the usual vicissitudes of all new engineering enterprises, has survived the dangers of ignorant childhood and stormy youth, and now in about the fortieth year of its existence, seems to have found its place in life, and bids fair to enter upon a vigorous manhood. The sphere of usefulness which seems particularly its own is that of transporting such materials as ores, clay and coal, etc., over rough and hilly country where a surface or trestle road would be very costly, or where grades have to be surmounted which would be impossible with ordinary traction by friction of driving wheels. It also finds a useful place in the carriage of such materials as already mentioned across rivers. Of the two methods, the "single rope" system in which single endless rope is kept in motion over guide sheaves and serves both to support and convey the buckets, and the "fixed rope" system in which a light endless traction rope hauls trolleys running on stationary cables as rails, the latter method has generally survived as the fittest. Much thought, skill and labor has gone to produce its successful simplicity. The speed is from 3 to 4 miles per hour. Clear spans of 1200 to 1700 feet are not uncommon, and one line has a clear span of 2250 feet at an incline of 45 degrees, carrying down loads of 1200 lbs. at each trip. This last is marked as a gravity road, the descending loaded bucket hauling up an empty. These lines ordinarily do not exceed a mile in length, though there is one a little over three miles long which has a daily capacity of 750 tons. There are, however, no long spans on this line and only 240 feet difference of level between loading and discharge terminals, an average grade of only 1½ per cent. The entire operating expenses of this line per annum, including depreciation, taxes, etc., are stated at 6 cents per ton mile for about 200,000 tons carried. For this distance and easy grade it is not clear that electric telpherage might not have been better. For wire rope tramways, where the grades are heavy or the line short, the traction cable has no real rival; but for long distance and nearly level lines with short spans, electric should beat cable haulage on overhead railways as it has on surface roads, and as wire rope tramways come more into general use, some application of the late Fleeming Jenkins electric telpherage system may well serve to extend their economical range.

THE remarks in last month's ELECTRICAL NEWS on municipal ownership of lighting plants, have excited adverse comment from the daily press advocating a city plant for Toronto. The gist of their criticisms is a sneer at what they are pleased to call our "time worn argument" that a large civic corporation in this country cannot be trusted to carry on business as economically and efficiently as a private company. That this truth is old enhances the discredit it casts upon the system of municipal government in the large towns of this country and continent. If it is old there is the greater need that it should be refuted by facts, and before asking for new opportunities to do this, it is incumbent on the civic representatives to use those already afforded them. Let them put their house in order and make a creditable record with what has been given them before they ask for more. Is the history of the Toronto Waterworks one to inspire confidence in our civic government? And how are we to believe that this history will not repeat itself, when at the present moment with our comparatively excellent Council, we see a sound and practical scheme for immediate relief by a tunnel to the island, blocked by a faction of aldermen who want to wait ten years longer and pay twenty times the money to get less pure water from Lake Simcoe in the end. Granted that the actual operation of civic waterworks, electric light and similar plants is in charge of the permanent officials, one of the most important of whom is the City Engineer, and that the present incumbent of that office is thoroughly capable and trustworthy so also have been some of his predecessors, and there's the rub. How many city engineers has Toronto had in the last ten years? We do not suppose that the most enthusiastic civic advocates will claim better business management by the city than by a private company whose existence depends on good management; and the plain truth of the matter is that with equally good management the city of Toronto would at best have just this one advantage in the competition, that it need only pay 4% dividends (in the form of interest on debentures) against 8% on the same capital that would be required from a private corporation. And, with such a narrow margin for competition, what man in his senses would invest in a business corporation which, like the city, changes its directors once a year and its manager every two or three years? In private life we don't entrust our money to a concern whose directors have shown themselves capable of dallying with a so-called engineering project to shunt Niagara Falls by emptying the Georgian Bay into Toronto Harbor.

AN English Royal Commission to inquire into the subject of "Electrical Communication with Lighthouses and Light Vessels," has recently issued its second report, which gives as an appendix a sub-report by Sir Edward Birbeck, who visited Canada and the United States to see what had been done on the subject in America. He speaks in very high terms of the complete and efficient system of telegraphic communication with Canadian lighthouses, but adds that the question of able communication with Canadian light vessels has not been taken in

hand owing to the necessity of moving many of them from their stations during the winter on account of the ice. Cable connection to a lightship is a difficult and costly matter at best, as the sea end of the cable must be securely anchored and provided with a watertight service, kept clear of the sea bottom, to allow the lightship to swing at its moorings. Ice and the necessity of moving the vessel would add greatly increased if not insuperable difficulties to direct cable connection. As a means of filling this gap in the otherwise very perfect Canadian system of lighthouse communication, recent experiments on indirect or inductive electric signalling are of special interest to us in Canada. It is now some years since Edison brought out his method of electrical communication by electrostatic induction without metallic connection, and applied it to transmitting signals, between a moving train and the ordinary telegraph wires running beside the track. It is a familiar fact that when a condenser of sufficient capacity is interposed in a line conveying a pulsating or alternating current, such as a telephonic current, the current is perfectly transmitted by electrostatic induction in the condenser, in spite of the open circuit. Edison simply increased the distance between the plates of the condenser. In the case of the moving train the tin roofing of the car was one plate, and the wire beside the track the other plate. A conducting sheet hung between the masts of a vessel would enable it to signal to another vessel similarly equipped, or to the land if a like conducting sheet were erected on the shore. In the recent experiments referred to, electromagnetic induction is employed, and electrical energy transmitted between two separated wires on the same principle as in a Ruhmkorff coil or an ordinary alternating current converter; the only difference being that the primary and secondary wires are separated by hundreds of feet instead of by fractions of an inch. Mr. Preece has been experimenting between two parallel lines of wire, and Mr. Stevenson between two coils. A trial system of the coil variety is being put up to establish communication between the North Unst lighthouse and the shore, half a mile distant. For lightships the method would be to lay out from shore a cable, and coil it on the sea bottom in a circle of large enough diameter that the lightship swinging at its moorings may always be within the circle, the second coil being on board the vessel itself.

MUNICIPAL LIGHTING.

ELSEWHERE in this issue we print the report of Secretary McGowan of the Toronto Fire and Light Department on the probable cost of operating a municipal lighting plant. It appears that City Engineer Keating was requested to make the estimate in the first place, and did so. But having had no experience in electric lighting he had to depend for his information, as is usual in such cases, on parties whose interest it was to have a city plant established regardless of what it might afterwards cost to maintain. The matter properly belonged to the Fire and Light Department, so as there was some doubt as to the correctness of the Engineer's figures, Mr. McGowan was instructed to report on the estimate. It is fortunate for both the taxpayers and electric light companies that Mr. McGowan, who has had charge of the city lighting for ten years past, is both an expert in those matters, and also an honest and fearless man who is prepared to do his whole duty regardless of aldermanic interference or adverse criticism of the press. We leave it to any of our practical readers to say whether the estimate is not a fair one, and thoroughly within the mark for a municipal plant. The wages are based upon what the city is now paying for similar kinds of labor, and the number of employees on what would be necessary for a plant run by a private company, to say nothing of the extra cost that would be entailed by pitchforking into office the numberless parasites that it seems to be necessary shall always feed on the body politic. The cost of 2000 candle power lights as supplied by the Toronto Electric Light Company is $108 per year for 1000 lights; Mr. McGowan's estimate is $103.85 each for 1300 lights. There is not an electric light company in existence who would not willingly take for their pay the actual cost price to the municipality, being content to take for their profit the difference between skillful, independent and economical management and the corrupt and extravagant methods of the average ward politician. The item in Mr. McGowan's estimate that has provoked the most opposition is the amount for taxes. The irate socialist says: "What is the use of placing this in you can't tax civic property." Certainly not, but you can and will lose the amount which the electric companies are now taxed if you destroy their property; and in all conscience, in Toronto that tax is high enough. There is another item that the Secretary has omitted, which would also be a proper charge against a municipal plant, and that is rebates charged for lights out. It is unavoidable, even with the best known appliances, that lights should sometimes fail. Lightning, sleet storms, accidents to wires through crosses, or from falling trees, and from numberless other causes. These, where as in the case of Toronto, the policemen report the lights that are out, amount to quite an item during the course of a year. Not only would a municipal plant lose the benefit of this, but the service would not be as effective, there being no incentive to attain perfection to save this item of expense. It is evident to those who peruse the City Engineer's estimate that, from the entire omission of important items of expense, such as globes, &c., that it is not a reliable one, and should therefore give place to the more thorough one of the Fire Department Secretary. We commend with much pleasure the study of the report to our electrical friends, and to politicians afflicted with the prevailing craze for municipal ownership.

CANADIAN ELECTRICAL ASSOCIATION.

A WELL attended meeting of the Executive Committee of the above Association was held in Toronto on June 25th. Several new members were elected. Some eight or nine gentlemen prominent in electrical circles have consented to prepare papers of interest to students and workers in the various departments of the electrical field, for the annual meeting to be held in Montreal in September. The exact date of the convention will be fixed shortly. It will probably be between the 20th and 30th of September. The meetings will be held in the Mechanics' Institute, will occupy three days, and promise to be very full of interest. A committee was appointed, comprising chiefly members of the Executive resident in Montreal, to further the arrangements. The Executive expect to be able to secure from the railways such favorable transportation rates as will enable a large proportion of the members of the Association from Ontario to attend the convention. An invitation has been extended by the authorities of McGill University for the Association to visit and inspect that celebrated institution. A drive to the summit of Mount Royal, a run down the Lachine Rapids, a visit to the Montreal Street Railway Company's power station, a trip over the Montreal Island Railway, and other forms of pleasant and profitable entertainment are being arranged for. Ontario members of the Association cannot do better than postpone their holidays until the latter part of September, and take in this convention in the commercial metropolis of the Dominion, the people of which are certain to afford them a good time.

PRESCOTT ELECTRIC STATION.

The steam engine used in this power house is one of Polson's 65 h. p. When first erected it was high pressure engine, but the directors decided some time ago to attach one of Northey & Co.'s condensers, so now it is run as a low pressure engine. The addition of the condenser has increased the power from 15 to 20, while it has reduced the consumption of coal about 7½%, consequently the change has been a most satisfactory and beneficial one.

In the power house they have two Reliance dynamos—an arc and incandescent. These dynamos are Easton's patent, and were manufactured by the Reliance Co., of Waterford, Ont. The arc dynamo has been running six years, and in all that time has not cost a cent for repairs. The incandescent dynamo has been running only five months; if it fulfils what it promises it will give as great satisfaction as the arc dynamo has done.

The Company use also the Diamond transformer, transforming the current from 1000 to 100 volts. The result is they can now supply 100 c. p. reduced to 1000 c. p., which under old circumstances could not be effected without making a series of 10 lamps.

Mr. A. H. Smith, of London, Ont., has been granted a Canadian patent for an improved trolley arm, and the Bell Telephone Co. the extension of a patent for connection devices for electric circuits.

REPORT ON COST OF CONSTRUCTION AND MAINTENANCE OF A MUNICIPAL ELECTRIC LIGHTING PLANT FOR TORONTO.

FIRE DEPARTMENT SECRETARY'S OFFICE,
Toronto, June 23rd, 1894.

To the Chairman and Members of the Committee on Fire and Light

GENTLEMEN,—In compliance with a resolution passed at the last meeting of your Committee asking for a report on the estimate of the cost of construction and maintenance of an electric lighting plant for the City as submitted by the City Engineer, I beg to say that the time at my disposal did not permit of my getting as much information in relation to the cost of installation of a plant as I desired, still from the particulars I have received I am of the opinion that an electric lighting plant of the capacity at present required for our city could be installed for the estimate submitted, viz. $310,000, but supposing the cost exceeded the estimate by $25,000 it would not be a very significant matter as it would be one of first cost only.

With regard to the cost of maintenance of plant as submitted by the City Engineer, I would say that from my experience and knowledge of the cost of operating a plant of the proposed dimensions, I am of the opinion that it is considerably underestimated, and beg to submit the following as a fair estimate of the annual cost of operating and maintaining.

ANNUAL COST OF OPERATING AND MAINTAINING STATION.

1 superintendent	$ 2,500 00
1 chief engineer	2,000 00
2 assistant engineers	2,000 00
1 electrician	1,500 00
2 oilers	1,200 00
2 dynamo tenders	1,500 00
1 dynamo cleaner	600 00
4 firemen	2,800 00
1 helper	500 00
20 trimmers, including two spare at $550 per annum	11,000 00
7 inspectors, at $600 per annum	4,200 00
1 foreman of trimmers and inspectors	800 00
1 horse, wagon and driver for lamp department, and keep of horse	975 00
5 linemen	3,000 00
1 team horses, wagon, harness and keep of horse for pole and line work	1,000 00
1 clerk	800 00
1 storekeeper	800 00
3 machinists	2,100 00
Materials for repairs to lamps, dynamos, engines and boilers	3,000 00
Maintenance and renewal of tools and implements for repair shop and linemen	500 00
Globes for lamps	1,950 00
Coal	39,420 00
Carbons	14,235 00
Oil, waste, etc.	2,000 00
Interest and depreciation	31,020 00
Insurance on say $140,000	2,100 00
Taxes on assessment of say $100,000 at 15 mills on the dollar on which a private corporation would have to pay	1,500 00
	$135,000 00

On the above basis the cost for 1300 lamps would be $103.85 each per annum.

If the cost of interest and depreciation, insurance, taxes, water, etc., is added, the cost per lamp would be about $170 per annum.

Respectfully submitted.

R. J. McGOWAN,
Secretary Fire Department.

THE MARITIME PROVINCES.

(Correspondence of the ELECTRICAL NEWS.)

The prospectus of the East River Electric Co., Ltd., of Pictou county, has just been issued. The capital stock of the company is $30,000. The prospectus sets forth that the idea has been conceived of supplying the residents of New Glasgow, Stellarton, Westville and Ferona with electric light produced by water power. With this object in view, the west branch of the East river has been examined by reliable engineers, who report that at the driest season of the year 200 h. p may be developed by means of a dam 30 feet high, located about 500 yards below the village of Hopewell, and further, that should more power be required in future, another dam may be built further down stream, from which the same flow of water may be used again, thus assuming a total of at least 300 h. p. available, to say nothing of existing dams at Hopewell and Eureka, which may be acquired if the profits of the undertaking are found to warrant it. A prominent electrician has been consulted, and his report is that 200 h. p. will successfully operate 2500 incandescent lamps at the distance of New Glasgow from Hopewell. With this assurance careful estimates of the cost of constructing and operating the required plant have been prepared, and the result is so encouraging that it is proposed to organize the East River Electric Co., Ltd., for the purpose of developing the scheme. It is estimated that the cost of constructing and operating the works will amount to $25,000. The estimated gross revenue from 2000 lights at 1¼ cents per night is $9000. The running expenses are placed at $3,500, which would leave a net revenue of $5,500, equivalent, the prospectus says, to 10 per cent. on $30,000 and a surplus of $2500 to be used in extending the business.

Business men, both in St. Stephen and Calais are seriously inconvenienced in their relations with each other because they have no efficient telephone service. The system which is in use is only an an apology for a service, and a very poor apology at that. It is generally admitted that a first class service would become popular in both these towns, and if one were to judge from what the business men say, the telephone would be about as good an investment as the capitalist could find for his money. The New Brunswick Telephone Co., realizing the great want of the people in this line, and the *field open to them, have made a proposition to the people of St. Stephen* and Calais, in which the company name the rates and conditions under which they will build the line. The offer has been favorably considered by a committee representing the citizens of both towns. The Board of Trade at its last meeting considered the proposition of the company. At present there are not more than half a dozen telephone subscribers in either of the towns mentioned. It is the intention of the citizens, however, to possess themselves of a line that shall be first class in every particular. They think that with such communication business will be greatly facilitated.

Calais will very soon have an electric railway. A large crowd of men have been at work upon it for several weeks and have pushed everything along rapidly. In a few days the work of laying the rails will have been finished. The poles are now being set for the wires. There was a strike among the laborers last week, but the vacancies were soon filled and the work went on the same as usual. The cars will be right up to date in the manner of construction.

A petition is being circulated and extensively signed by ratepayers of Summerside, P. E. I., asking the council to have an electric light plant put in operation in that town. Summerside is without any doubt greatly in need of electric light. With one exception it is the largest town on the island, and the manner in which its streets are now lighted is certainly away behind the age. The majority of the citizens seem to be fully alive to the importance of the scheme, and it is believed the council will accede to their wishes and order that an electric plant be placed in operation.

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

ORGANIZATION OF AN ASSOCIATION AT PETERBOROUGH, ONT.

149 Borden St., Toronto, June 18th, 1894.

Editor ELECTRICAL NEWS.

SIR, The members of the C. A. S. E. will be pleased to learn that another addition has been made to the order. The new Association will be known as Peterborough No. 14 C. A. S. E. The organization took place on June 13th in the Sons of England Hall. There are two halls, a large main hall and a small one- the latter has been engaged for the meetings of the new Association.

About fifteen engineers were on hand, when the President Bro. S. Potter, chief engineer Canadian General Electric Co., called the meeting to order, and asked the writer to take the chair and proceed with the organization.

After the officers were elected they were duly installed in their respective positions, and then the members were called in for initiation. President Potter then called on the writer to address the members on the aims and objects of the C. A. S. E., which he did to the best of his ability, telling of the good which had been done by the Association, advising them to purchase a black board and question box, and to encourage the discussion of all matters in which engineers were interested. The attitude of the C.A.S.E. towards our employers was also touched on, and met with the hearty approbation of all present, as it must always do with all fair minded men. President Potter then took the floor and addressed the members in a neat and pleasant speech, during which he asked each individual member to do his utmost to make No. 14 one of the most useful Associations in Canada. He trusted that every member would make it a point to bring up some subject for discussion, and that they would never hesitate to express their opinions, as all were there to learn, and he knew of no better way for engineers to become educated than for them to meet together for mutual improvement and discussion of subjects relating to the duties of an engineer in his every day work. Bro. Potter expressed the opinion that No. 14 would never probably exceed 20 or 25 in membership, but he believed it would prove to be a staunch and useful Association, and he hoped a credit to the C. A. S. E.

Vice-Pres. Robison and Bro. Thos. Duncan followed and expressed their determination to make the Association a success. Bro. Duncan was at one time a marine engineer, a good arithmetician, and willing to give his knowledge to the Association.

Several other members expressed their determination to work hard to make the new Association a success.

The officers of No 14 are. President, S. Potter, vice-president, C. Robison; treasurer, W. Hunt; conductor, W Taylor; doorkeeper, John Morency; trustees, Wm. Wilson, Thos. Duncan, J. F. Smart; Secretary, W. Sharp, engineer steam laundry, Charlotte street. The Association will meet in the Sons of England Hall, on the 2nd and 4th Wednesday of each month. The members of No. 14 will be pleased to hear from all other branches, and papers on any subjects will be thankfully received.

This Association has made a good start, and judging from the sincerity and intelligence of the members it will be one of the most useful and progressive branches in the Province.

All members of the C. A. S. E. will wish Peterborough No. 14 long life and success in helping to educate the engineers of Canada, a correct understanding of steam and its application to power. Yours very truly,

ALBERT E EDKINS,
Prov. Dept., Ontario.

HAMILTON, NO. 2.

On Friday evening, June 15th, Hamilton No 2, elected their officers for the ensuing term as follows. Joseph Langdon, president; Peter Bailey, vice-president; Wm. Norris, corresponding secretary; A. Nash, financial secretary; Wm. Nash, treasurer; Thos. Carter, conductor; Wm. Stevens, doorkeeper, Peter Stott, Robert Mackie, Andrew Robb, trustees.

During the evening an important discussion took place on the power of heat when applied to water. The subject was introduced by Bro. Wickens, of Toronto No. 1, who handled it in a very able manner.

Mr. J. J. York, Executive Secretary, has obtained a first class certificate under the Ontario Engineers' Act.

During a recent visit to Montreal, Mr. A. E. Edkins passed the required examination and received a Boiler Inspectors certificate under 57 Vic., Chap 30, an Act of the Quebec Legislature respecting steam boilers and motive power in industrial establishments.

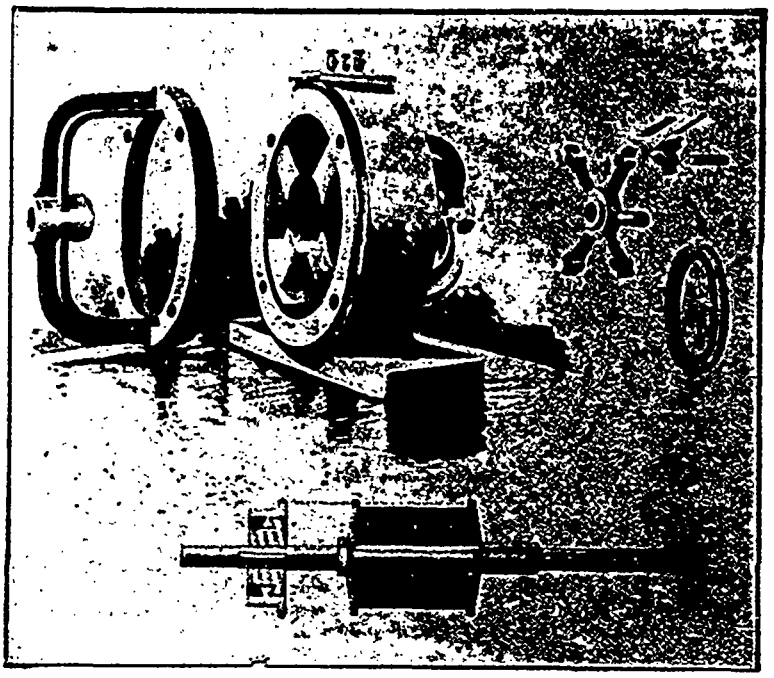
OUTFIT OF APPARATUS FOR STUDENTS OF ELECTRICITY.

The staff of instructors of the "Institute for Home Study of Electricity," conducted by The Scientific Machinist Co., of Cleveland, O., have designed an outfit of apparatus for their students, patents on most of which are pending. Descriptions and illustrations of these are here presented.

DESCRIPTION OF DYNAMO AND MOTOR.

This machine is of the iron-clad type, with poles projecting radially towards the centre.

It is fitted with self oiling bearings of ample size, adjustable brush holder, two sets of copper brushes and is in every respect a practical machine. In addition to the machine, as above, there are sent four insulated rings which



LINCOLN-AMSTUTZ EXPERIMENTAL ¼ H. P. DYNAMO AND MOTOR, FOR STUDENTS, SCHOOLS AND COLLEGES.

may be secured and connected to the commutator for alternating current working. By the use of only one size of wire on field and armature, the machine is variably connected, full details of which occur in the course, as follows

1. As a four pole shunt wound dynamo delivering direct current at constant potential—two brushes only.
2. As a four-pole compound wound dynamo arranged so that the voltage rises as the load is increased—two brushes only.
3. As a series four-pole dynamo—two brushes only
4. By changing the connections of the armature bobbins to the commutator, we may cause the machine to furnish twice the current at ½ the voltage. Connected in this way the machine will operate as a four pole shunt wound dynamo giving direct current at constant voltage four brushes.
5. Also as series dynamo giving twice the current at half the voltage—four brushes.
6. As a four pole shunt wound motor running at constant speed corresponding to case 1.
7. As a four pole compound wound motor where the speed will drop when the load comes on, corresponding to case 2.
8. As a four-pole compound wound motor where the speed rises when the load comes on, corresponding to a variation of case 2.
9. As a four-pole series motor, corresponding to case 3.
10. By changing the connection and using four brushes we get a four-pole motor running at twice the speed it did before changing and running at double speed and power corresponding to case 4.
11. As a four-pole series motor operating at twice the speed it did before the change corresponding to case 5 was made.
12. Before rewinding the armature we have a two pole shunt dynamo.
13. Corresponding to 12 we have a bipolar shunt motor.
14. A bipolar series dynamo.
15. A bipolar series motor.

In all the above cases the machines are self-excited and a large number of changes could be made by various combinations with separately excited fields, a number of which are outlined as follows

16. By the use of two of the insulated rings we may have a four-pole alternating current single phase dynamo.
17. Corresponding to this we have a four pole single phase synchronous motor
18. By changing the armature winding again we may have a two-pole single-phase alternating current dynamo.
19. And corresponding to this a two-pole single-phase synchronous motor
20. By the use of four of the rings we may have a two phase four pole alternating current dynamo.
21. By an adjustment of the rings a four-pole three-phase alternating current dynamo is procured.
22. Corresponding to case 20 we have a two-phase alternating current motor
23. Corresponding to case 21 we have a three phase alternating current motor
24. By the use of the two pole armature winding we may get a two-phase two pole alternating current dynamo.
25. Also a three-phase two-pole alternating current dynamo

In all cases when the machine is used as an alternating current dynamo or motor the fields will have to be separately excited. The armature and field coils winding may be made with larger or smaller wire than is sent with the machines so as to employ higher or lower voltages and more or less current. The machine is very well adapted for a two or four pole plater. In connection with the machine, instruction diagrams of field and armature windings and connections are given which make possible the above mentioned variations.

The volts and current produced by a winding of various sizes of wire is also given. More can be learned about the volts and current produced by a dynamo by making the changes required to transform this machine than in any other way.

Our students require this unwound. The experience gained in winding and connecting, which is a part of our course, is invaluable.

Some suggestions for an inexpensive foot-power device will be sent with every machine, for those who have no power with which to drive a dynamo.

DESCRIPTION OF COMBINATION MEASURING INSTRUMENT.

In this instrument an annealed soft iron core is drawn into a magnetic field obliquely. To accomplish this the spool on which the coils are wound is made with an oblong opening the height of which is four or five times its breadth. This allows the core the necessary freedom of motion. By the proper adjustments the direct reading scales can be made quite uniform from one end to the other. It will be seen that there are no multiplying devices to get out of order, the only motion being the movement of the core and pointer on their support. The instrument is wound with two coils, one of fine wire and the other, of coarse.

The coarse wire is connected between the two large terminals and the small wire between the small binding post and the large one next to it. The four scales are obtained from the two coils in this manner.

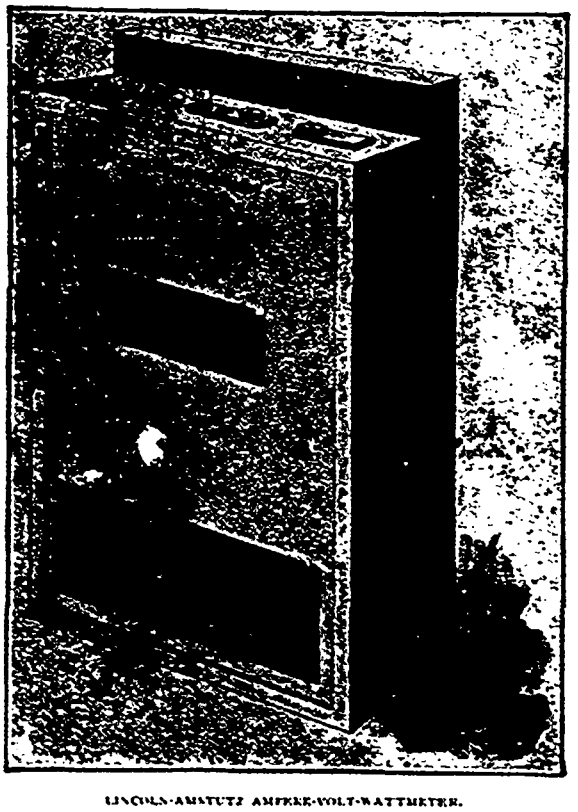
1. The ammeter scale is calibrated with a Weston ammeter in series with the coarse wire coil.
2. The voltmeter scale is calibrated with a Weston voltmeter in parallel with the fine wire coil.
3. From the known resistance of the fine wire coil and the volts at its terminals the fractional part of an ampere in the fine wire coil is found and given on the scale of milli-amperes.
4. Both coils are connected to the circuit at the same time, a wire from one side being lead to the middle binding post, the current then flows through the coarse wire coil to the lamps and to the other side of the circuit. Another wire from the small binding post is carried to the other side of the circuit so that the fine wire coil is in parallel with the coarse wire coil and the lamps, and is subject to the same voltage as the lamps. Both the fine and coarse wire coils tend to draw in the iron core and by proper calibration the watts are read.

Gravity is the force opposing the magnetic pull, and in *setting up the instrument care must be used that the* pointer stands at O.

REFLECTING GALVANOMETER.

The galvanometer offered herein is an astatic instrument with a resistance in the coils of about ½ ohm, and may be called a reflecting galvanometer of low resistance. It is adapted for the detection and measurement of low electromotive forces, and will be found of special use in the measurement of current produced by thermal electrical action and currents produced by induction in the earth field. It is especially adapted as galvanometer in use in Wheatstone's bridge.

The piece is not highly finished or polished, but has all the essential elements of instruments listed by Queen & Co., at $100.00. The lens which is adjustable is provided to concentrate the light from the lamp upon a little revolving mirror. The system to which the mirror is attached is made up of two small magnets, one inside the coil and one outside the coil, magnetized to precisely the same strength and rigidity, attached to each other



LINCOLN-AMSTUTZ AMPERE-VOLT-WATTMETER.

and to the mirror, and held so that the north seeking pole of one is in the same plane and right above the south-seeking pole of the other magnet. By this arrangement the system of the two magnets and mirror is not subject to any directive tendency, when supported in a uniform magnetic field. The support consists of a single silk fibre and there is an adjustment provided, *so that the needles will swing free, when set in the coils. It is always* necessary to have the needles hang parallel to the direction in which the

wire on the coils is wound, when the needles are at rest. The same experiments may be performed with this instrument, as can be performed with more expensive instruments. It is in fact almost if not quite as delicate as a more expensive instrument. For instance, a piece of German silver and iron wire can be connected to the terminals of the instrument, and the junction of the silver and wire heated between the finger and the thumb, when sufficient current will be produced to give a decided deflection. Second A coil of wire two or three turns, 1 foot in diameter, can be made up, and if the coil is reversed suddenly in the earth field, the induced current will give a very decided deflection.

For experiments in unipolar induction, this galvanometer can be used, for currents which are one hundred times smaller than can be detected on a calabrating coil of a Weston voltmeter.

In setting up the instrument, select a lamp of such height, that the flame will be approximately at the same height, that the mirror on the galvanometer and lens are. To get the best results the lamp should be covered with a tin hood or round paste board box, with a hole cut in it, so as to allow a beam to strike the lens. This beam will be focused on the mirror by the lens and be reflected by the mirror on the screen, or what answers equally as well, the white wall of the room. It will now be seen that if the mirror is moved ever so little, the spot of light will be moved on the wall a considerable distance.

Two spots are provided in the instrument so that no more than a certain deflection can be obtained.

In order to get the instrument as delicately adjusted as possible, a magnet should be so placed in the neighborhood, that the length of the swing of the two little magnets and mirror is as great as possible.

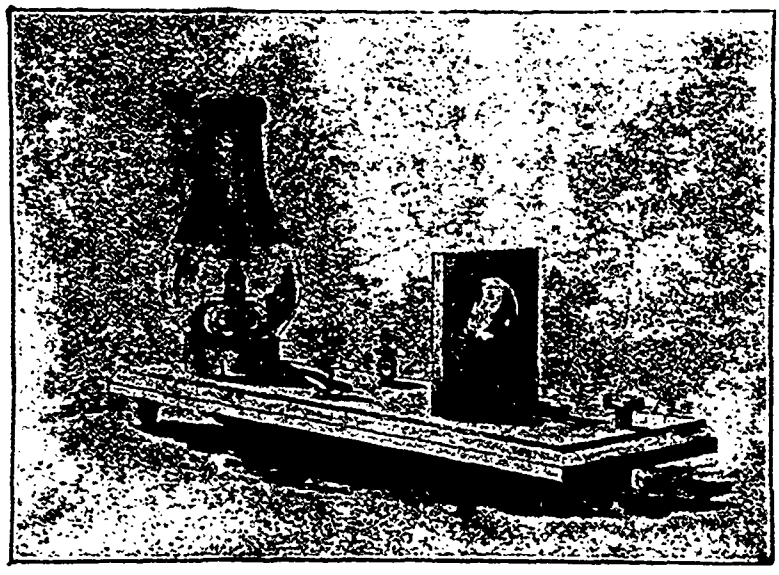
That is, if the field is adjusted, so that the time of the swing from one extreme to the other is ½ sec., the instrument is only one half as delicate as it would be if the time of the swing was 1 sec.

For investigation of small electro-motive forces, and for use as galvanometer on Wheatstone's bridge, this instrument we believe will be unexcelled. —The SCIENTIFIC MACHINIST CO., Cleveland, O.

SOME DATA ON THE COST OF TELEPHONE WORK IN NEW YORK CITY.

THE Metropolitan Telephone and Telegraph Company furnish the following interesting information with regard to certain features of their New York Telephone System and the Broad Street Exchange:—

The Broad Street Exchange, which serves the district bounded by Wall street and Broadway from Wall street to Battery, is the eighth central of the New York telephone system. It is one of the four larger offices which have been placed in fire proof buildings specially constructed to contain telephone centres In every feature it represents the most modern development of telephone engineering, and so rapid has this development been, that in no single item of its equipment does the Broad Street Exchange resemble the equipment of a telephone exchange of four years ago.



LINCOLN REFLECTING GALVANOMETER

As an illustration of the continual reconstruction of a large telephone plant that is rendered necessary by the constant improvements in apparatus and methods produced in response to the continual demand of the public for increased telephone facilities and for perfect service, the Eighteenth street Exchange is a case in point This exchange was recently moved to a new building, and to effect the removal an entirely new central office equipment was constructed, and the equipment of the old office, which had been in service *a few days more than four years* was abandoned and the greater part of it was sold as junk.

The Broad Street Exchange at present supplies telephone service to some 1,100 subscribers, all of whom have been transferred from the Cortland street office, which, until lately, served nearly 5,000 subscribers and was overcrowded. The ultimate capacity of the Broad street office is for 3,000 subscribers. It contains the last type of metallic circuit multiple switchboard, a notable feature of which are the ingenious self-restoring indicators. These indicators return to their normal position automatically, thus relieving the operator of two manual operations, and consequently quickening the service.

During the past year or two improved methods of construction of lines and the placing of underground cables have been pushed with great vigor, resulting in the removal of old overhead wires and their substitution by copper metallic circuits throughout. In the Broad street district few old sytle lines now exist, and not a single wire enters the exchange overhead. All the subscribers' lines are brought into the building through the basement in lead covered cables, each containing fifty metallic circuit conductors. At the ends of the cables the conductors are connected to lightning arresters, which prevent dangerous currents from reaching the switchboard apparatus. The conductors next pass through a special switchboard or connecting rack where they make their union with the wires of the operating switchboard proper. This connecting rack is designed to allow of the junctions between the subscribers' lines and the switchboard being interchanged whenever necessary, and gives great flexibility in the apparently complicated system of wires.

Special features of interest are the generating plant, where current is produced for charging the switchboard transmitters and for ringing the subscribers' bells, the desk of the "wire chief" is provided with the apparatus for testing the subscribers lines and locating "troubles; the desks of the monitor and exchange manager, are equipped with lines running to all parts of the switchboard to enable proper supervision of the operation to be maintained.

The telephone system of New York City consists at present of eight exchanges, equipped with metallic circuit multiple switchboards, having a total accommodation for 15,000 subscribers, upwards of 9,600 subscribers' stations, 800 private line stations, and 20,000 miles of underground wire. The entire system is constructed on a basis of exclusive metallic circuit working. About sixty per cent. of the subscribers now have metallic circuit lines and equipment, and the conversion from the old style grounded lines to metallic circuits is progressing with great rapidity.

With a metallic circuit line and office equipment a New York telephone subscriber can talk from his own desk to any one of upwards of 100,000 telephone subscribers in other cities, some of them over a thousand miles distant. The extraordinary development of telephony in America is in striking contrast with the state of the art in Europe, where subscribers can get only local service for their own instruments, and, to use a long distance line, must go to the terminus of the line, making an appointment with the distant correspondent first by telegraph.

There are between 80,000 and 90,000 conversations by telephone each day in New York City, and the average use of the telephone by each subscriber is 16 times daily. Many busy subscribers use their telephones from 100 to 200 times daily

For the entire system there are over 400 lady operators. About 250 are on duty at the switchboards at the same time. The average number of connections made daily by each operator is a trifle under 400. At every exchange, comfortable sitting rooms, provided with lockers, tea and coffee urns, etc., are established for the use of the operators when not on duty at the switch board.

A peculiar feature of the daily business of a telephone exchange is its enormous fluctuation. Although the service is permanent, the greater proportion of the twenty-four hours' work is compressed into two periods of about two hours each. In order to cope with these high pressure periods without delay in the service the entire plant and personnel of the system have to be organized as if the whole of the day's work were on the same plane. Besides the operators there is at each exchange a skilled force of electric wiremen constantly engaged in making connections and keeping all parts of the plant in sufficient working order. None but skilled labour is employed in any part of the telephone system.

The working force needed to maintain the telephone service consists of about 1,000 persons, an average of one employee to every nine subscribers. The technical work is carried on by departments, each having a large force of men under a responsible head. Some idea of the amount of construction work done can be gained from the fact that during 1893 more than 3,000 lines were built and an equal number of stations equipped, and more than 2,000 disconnected and removed.

AN engineer observed his steam gauge indicating a higher pressure than his safety valve spring was set for. He slackened the spring, but the gauge kept rising and the steam did not blow off. When the pressure rose to 200 pounds he became alarmed; and as he could not start the engine he started the injector and opened the water blow-off cock. The damper being closed, this had the effect to prevent further increase of pressure. On examining the safety valve it appeared that the brass seat of the valve was a bushing put into an iron casting, that it had become loose, and that the steam had pressed it up against the valve. As the valve rose the seat followed it, and there could not have been a release of steam until the bushing was pushed out of its hole.

ELECTRIC RAILWAY DEPARTMENT.

PORT ARTHUR ELECTRIC RAILWAY.

THE Port Arthur Electric Railway is the only street railway in America that is owned and operated by the town, and it is an interesting experiment in municipal undertakings to see what the outcome of this venture will be as far as the feasibility of towns operating their own railways.

When Fort William started to build up under the favorable auspices of the Canadian Pacific Railway, better communication was required between the two towns. For years stages in winter and steam ferries in summer, with probably three or four trips per day, were found quite sufficient for ordinary local travel, and people paid cheerfully twenty-five cents for the privilege of making the trip either by wagon or boat. It was found that this would not do for increased travel; then the question was, what would be the best method of improving it, and it was considered that as the enterprise for some little time would not be a paying one, the proper method would be for the town of Port Arthur to build the railway itself, so that whatever little loss there might be in operating it, would be borne by all the taxpayers who were benefitted.

POWER HOUSE, PORT ARTHUR ELECTRIC RAILWAY, SHOWING WATER POWER AVAILABLE.

The people originally voted seventy-five thousand dollars, which it was considered at that time would be sufficient to complete the railway, not only to Fort William, but to West Fort William.

However competent municipalities may be to manage monopolies, they were not so competent to construct them, and the money originally voted did not do as much work as might reasonably have been expected.

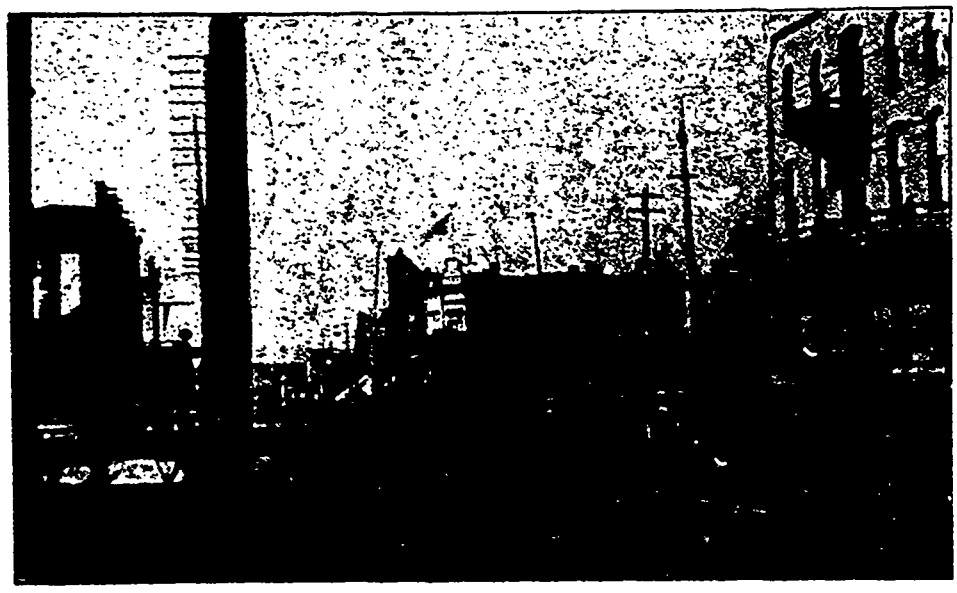
After voting the money the most serious question that the municipality then had to tackle was the question of getting into Fort William. The people of Fort William thought that the building of the railway was going to be to their detriment rather than to their benefit, and legislation had to be secured. This delayed the completion of the railway a year. The people of Fort William made it a sine qua non that the railway should be built not only to Fort William, but through to West Fort William, and that the rates of fare over the line for a continuous trip should not exceed 5 cents single fare, 6 tickets for 25 cents, 8 workmen's tickets for 25 cents, 10 school children's tickets for 25 cents. Forty thousand dollars more was voted to complete the railway and to put it in first class shape. This was done last October, and it has been continuously operated ever since.

During the winter season a round trip an hour is made between Port Arthur and West Fort William, and in summer three trips in two hours, between six o'clock in the morning and midnight. The average number of passengers carried daily is about one thousand, and however much the Fort William people may have objected to the building of the railway at the start, they find now that it is a great benefit as well as a great convenience.

The power house is situated at Current river, about one and a half miles east of the eastern terminus of the railway, and at present electricity is generated by steam. However, on Current river at this point, within 2000 feet, there is a fall of 80 feet; 40 feet of this can be very easily utilized at an expenditure of some $20,000. That would give ample power to operate not only the railway but an electric lighting plant as well, and it is expected that the town will improve the power, put in a lighting plant, and operate both it and the railway with the power there generated. This, however, will hardly be done this year, and it may not be done at all by the municipality, as the opinion of the ratepayers at present is that it would be better to get the railway out of the arena of municipal politics by leasing it for a term of years to some company or individual who would furnish a service equal to that now furnished by the town.

The system of operating the railway is, that the receipts are paid over to the town treasurer, who furnishes the conductors with tickets; the superintendent has charge of the operating department and maintenance, and the general supervision of the whole matter is under the control of the chairman of the Railway Committee, who likewise is responsible to the Council.

The railway in its entire length is about seven and six-tenth miles. It starts at the Canadian Pacific Railway station in Port Arthur, thence along Cumberland street, the main street of the town, to Fort William road. When it reaches the Fort William road the track is elevated, the same as an ordinary steam railway, in order that there may be less trouble with snow in winter; this elevation continues until it reaches Simpson street, the main street of Fort William, along which it runs. From Fort William to West Fort William the railway is laid along the travelled highway, and it terminates very close to the Canadian Pacific and Port Arthur, Duluth and Western Railway stations.



PORT ARTHUR ELECTRIC RAILWAY, THROUGH PORT ARTHUR.

The equipment consists of three Patterson & Corbin 18 ft. vestibuled upholstered cars—electric head and interior lights; electric bells and heaters; Bennis trucks and elliptic springs. Two of the cars are equipped with two No. 14 20 H. P. Edison motors to each car, and one with one 30 H. P. No. 800 G. E. Co.

motor. There is also one 12 ft. flat car for freight and construction use.

The cars have averaged about 200 to 240 miles each per day, and have been singularly exempt from any accident.

The car barn is a handsome structure 120×50 feet, with offices, repair shop and 1 storage rooms, space for 6 cars, electric lighted, and situated in the centre of the town.

The power house is a frame structure 75×75. The engine is a Wheelock 150 H. P. compound condensing, with boiler to suit —all set on massive stone foundation—the whole work being laid with Portland cement. The generator is the Edison 45,000 watts, No. 16.

The road is 4 ft. 8½ in. gauge, 40 lb. T rails (steel), with ties, two foot centres, planked on each side of rail and well ballasted. Two Johnston spring turnouts are used, also one patented railway crossing or diamond. In crossing the Port Arthur, Duluth & Western Railway, a metallic telephone circuit connects with power house from Fort William terminus of line; also turnouts and car barn.

The overhead construction is of a very elegant and substantial description, double poles being used through both towns, with brackets on single between the towns. The trolley wire is No. 4 B. & S. hard drawn copper, the current being fed to it every fifth pole (600 feet) from a No. 1 insulated feed wire, Edison system; also a second feed wire, No. 00, is run direct from the power house to a point about ⅔ the total length, where it feeds directly into other, all being well protected by 8 Watson lightning arresters.

QUESTIONS AND ANSWERS.

Edgar Carr, Electrician for the Brockville Light and Power Co., writes: In this power house they have one Ball and one Reliance machine. At times the Reliance works all right at commencement of run, but after three or four hours work, begins to cut and spark. This cannot be caused by uncleanliness, as both commutator and brushes are cleaned and intently watched. Sometimes the machine runs all right for a week or two, and then commences to act as before stated. This occurs when both machines are running at the same time. The Reliance machine acts all right when run alone. What is the cause of the difficulty, and what the remedy?

ANSWER.—The Reliance Electric Mfg. Co., to whom we referred the above enquiry, write us as follows:—Re Brockville dynamo sparking, you failed to state whether dynamos were run in series or multiple; we take it that the latter is the case, and each dynamo is supplying a separate current. The trouble only occurs when both machines are running; when run alone the Reliance machine does its work properly; in this case it must be influenced in some way by the other machine. It would therefore appear that the machines were set too close together, and that one had a stronger field than the other, which would have an influence over the weaker machine, and thereby distort its field circuit, causing it to spark, or there might be a ground between the line or machines in such a way as to cause an excessive current to flow through the armature of the dynamo complained of.

"W. N.," Hamilton, Ont., writes: Would you please answer the following questions: (1.) What size storage battery would I require to run 20 incandescent lamps with a voltage of 110 ½ ampere per each lamp, to run 5 hours? What would be the cost of such a battery? Also how long would the same battery run a one-horse power motor? (2.) Would it be possible to regulate the voltage on the lamps separately while running lamp and motor off the same dynamo at the same time and still retain the proper voltage on the lamps? Please furnish rules and examples with your answers to these questions.

ANSWER.—(1) Storage batteries are rated in ampere-hour capacity per cell, and each cell, of the usual type, gives 2 volts. 20 lamps ½ ampere each take 10 amperes current; to run them 5 hours would therefore require "50 ampere-hour" cells, and 55 such cells would be needed to give 110 volts. 50 ampere-hour cells would cost about $9.00 each. These small sized cells are relatively more costly, and you could, at less expense, use for 20 lamps of 1½ amperes, and 40 volts each, a battery of twenty 150 ampere-hour cells, costing about $19.00 per cell. A motor which would give out 1 horse-power for 5 hours continuously would take the same size battery as required for 20 lamps for 5 hours. (2) You could only do so by using a resistance in series with the lamps or the motor in series with whichever of the two needed the lowest volts, and varying the resistance to absorb the difference between the volts required and volts given by the dynamo.

SPARKS.

The courts have granted an order for the winding up of the Toronto and Richmond Hill Street Railway Company.

The Hamilton City Council will endeavor to compel the local Street Railway Co. to put vestibules on their cars.

The name of the Moncton, N. B., Tramway Co. has been changed to the Moncton Street Railway, Heat and Power Co.

Experiments are being made at Hamilton, with the transmission by means of a third rail, instead of the overhead trolley, of electricity for street railway purposes.

The Montreal Street Railway Co. are said to have in contemplation the erection of a large power house in the centre of the city, with land sufficient for tracks and car barns.

On the 27th of June, conversation was successfully carried on between London, Ont., and New York, over the new metallic circuit recently completed by the Bell Telephone Co.

In response to a petition from a number of citizens, the Hamilton Street Railway Co have consented to establish a limited Sunday service If the service can be made to pay, it will be continued, but not otherwise.

The Council of Calgary have granted a five years contract for street lighting to Mr. P. A. Prince. The contractor agrees to furnish twenty-five 1200 C. P. lamps at $7.00 per month each, with a discount of fifteen per cent. for prompt payment.

The G. N. W. and C. P. R. Telegraph Companies are receiving well-merited ipraise for the expedition with which the election returns were collected from all parts of the Province. The returns from nearly all the constituencies were in before 9:30 p.m.

PORT ARTHUR ELECTRIC RAILWAY—CONSTRUCTION BETWEEN PORT ARTHUR AND FORT WILLIAM.

The great chimney in connection with the Toronto Railway Company's power house has been finished. President McKenzie and several officers of the company ascended to the top of the chimney, a height of 375 feet, for the purpose of laying the finishing brick.

A franchise has been granted to Messrs. Legier & Sons to build and operate an electric street railway, and to supply light, heat and power in the city of Belleville, Ont. Construction work will begin at once and the road is expected to be in operation by the end of the year.

The Toronto Railway Co. express their intention to extend their Mimico line westward to Oakville, and possibly through to Hamilton. Residents along the route of the proposed extension are arranging for meetings to ascertain what amount of financial support could be secured for the project.

The London Street Railway Co. is reported to have made another offer to the City Council for the privilege of running electric cars over the streets of that city The offer includes eight fares for a quarter. This is certainly a most liberal offer, and one which the Council would do well to accept.

As a result of the recent amalgamation of the Winnipeg Street Railway Co. with the Winnipeg Electric Street Railway Co., the former company are endeavoring to arrive at an understanding with the Council regarding their proportion of taxation for street pavements and the removal of their horses from the streets.

Mr. Cunningham, chief engineer of the Montreal Street Railway Co., proposes a system of delivery of mail matter to the city suburbs by means of electric mail cars, specially constructed for the purpose. The Postmaster of Montreal is said to have approved of the idea, and the Government is said to be willing to adopt the new method.

The Hamilton, Grimbsy and Beamsville Electric Railway Co., are still having difficulty in securing right of way for their line. Some of the property owners along the route are evidently trying to force the company to pay them an exorbitant price for their land, but the courts are in some instances discounting the claims by 75 per cent. and upwards.

The annual report of the Chaudiere Electric Light Co. shows that there were installed during the last year, 8,000 lights, the company having in operation a total of 26,000 lights. The following gentlemen were re-elected directors of the company:—Messrs. Brophy, Soper, McRae, Ahearn, Workman, R. & W. G. Hurdman, W. Scott and W. Hutchinson A dividend of eight per cent. was declared.

The recent meeting of the American Society of Mechanical Engineers in Montreal, was one of much interest. There were between two and three hundred of the members of the Association in attendance. The papers and discussions were of a most valuable character. As usual, the citizens of Montreal tendered their warmest hospitality to the visitors. Addresses of welcome were presented by the Canadian Society of Civil Engineers, and the Canadian Association of Stationary Engineers.

The illustrated article under the heading "An aid in Educating Motormen," which appeared in the ELECTRICAL NEWS for June was copied from the Street Railway Review of Chicago, but through an oversight proper credit was not given to that journal.

CAR TEST.

By W. F. McLaren and J. H. Meikle, Jr.

On Monday, 26th March, we made a test of one of the cars belonging to the Hamilton Street Railway Co. We had a special car for the purpose, and Mr. W. W. Dean, the electrician, acted as motorman.

The results of the test are shown in the accompanying table. The great bug-bear of car-testing is the accurate determination of the speed. This was done as accurately as possible by counting poles passed in each ten seconds during the run, poles being spaced about 40 yds. apart. Readings were taken every 5 secs on the following instruments: a volt-meter between the trolley wire and rails, a volt-meter between the brushes of one of the motors, and a mili-volt-meter, graduated in amperes and attached to the terminals of a 200-ampere shunt, which was connected in the main trolley circuit.

Only those parts of the run where most reliable readings were obtained are shown in the table, average volts and amperes being used in the computations. The armature resistance is .52 ohms. Knowing this we were able to calculate the drop in the armature, and determined the counter e. m. f. by subtracting this drop from the brush volts. The ratio of the counter e. m. f. to the brush volts gives us the motor efficiency. The computation of traction effort is based on the assumption that a pull of

RESULTS OF CAR TEST.

Streets.	Grade.	Feet per minute.	Miles per hour.	Average Current.	Trolley Volts.	H. P. Supplied.	Brush Volts.	Drop in Armature.	Counter E. M. F.	Traction effort lbs.	H. P. developed.	Torque ft. lbs.	Efficiencies. Car.	Efficiencies. Motor
Emerald to Wellington on King.	2	1400	15.9	38.4	437.5	22.5	407.5	10.0	397.5	336.0	14.25	164.5	63.4	90.8
McNab to Bay on King.	.6	1100	12 5	44.2	427.2	25.3	391.1	11.5	379.6	179.2	5.97	87.8	23.6	88.8
Bay to Caroline on King.	.8	1100	12.5	41.0	415.0	22.8	375.0	10.6	364.3	201.6	6.71	98.8	29.4	87.9
Caroline to Queen on King	2.7	1100	12 5	52.8	403.9	28.5	357.3	13.7	343.6	414.4	13.78	203.0	48.3	85.1
Queen to Pearl on King	1 3	900	10.2	53.6	418.0	30.0	373.0	13.9	359.1	257.6	7.02	126.0	23.4	90.3
Oak to Hannah on Locke.	1 3	1020	11.4	54.8	409.8	30.1	352.8	14.2	338.6	257.6	7.80	126.2	25.9	82.7
Caroline to McNab on Herkimer.	1	1300	14.8	40.2	429.7	23 1	393.3	13.5	370.8	274.0	8.82	109.7	38.1	96.5

Average car efficiency, 36%. Line, 80%.
Average plant efficiency (from coal to generators) 6 83%. | Total efficiency of system 1.95%.

STARTS.

Street.	Grade.	Maximum current.	Trolley Volts.	H. P. supplied.	Traction effort.	Torque.
Ferguson on King.	2	77	420	43.3	616	302
James and King	6	77	445	40 5	459 2	225
Main and Margaret	0	83	425	47.3	392	192
Main and Lake	0	103	405	56 0	392	192
Herkimer and Locke	0	117	410	64.3	392	192
Queen and Herkimer	1	137	400	73.5	504	247
King and James.	0	77	442	45.6	392	192

20 lbs. per ton is required to keep the car moving at a uniform speed on a level; the necessary increase being added for grades. Let W = weight of car and passengers in tons, and P = % of grade.

Then traction effort $= W \times 20 + W \times 2000 \times \frac{P}{100} = W \times 20(1+p)$

For starting torque we use 70 lbs. per ton and have

$$W \times 70 + W \times 2000 \times \frac{P}{100} = W(70+20p).$$

We estimated the weight of the car and the passengers to be 5.6 tons.

The horse power expended in moving the car is:

$$\frac{\text{Traction effort} \times \text{speed in ft. per min.}}{33000}$$

The horse power supplied being determined from the amperes and trolley volts, we get the car efficiency from the ratio of these two. The total torque on each armature is measured by half the traction effort multiplied by the radius of the armature in feet This radius was .98 ft.

On 27th March we weighed the coal used during a 12 hour run, and also read the ammeters every two minutes during this time, and the volt-meter every ten minutes. The amount of carbon in the coal was afterwards determined by a chemical analysis. Thus, knowing the amount of carbon supplied to the furnaces, and assuming 14500 B. T. U. per lb. of carbon, we can compute the horse-power supplied. Taking average volts and amperes, we get the electrical horse power generated. From the ratio of these we determined the plant efficiency to be nearly 7 . From the ratio of the average trolley volts read on the car test to the average volts read at the station, we determined the line efficiency to be 80 . The average car efficiency being 36%, we get about 2 for the efficiency of the system.

The trolley on the car tested was not in very good shape and the wheel frequently came off the wire on curves. The large starting currents shown on the table were obtained in starting on curves, and though these stops were accidental, yet they serve to show the danger of stopping a car on or at the beginning of a curve.

THE CONSTRUCTION OF STREET CARS.

In the construction of street railway cars it is desirable to employ the least amount of material, which will give the strength required in the work for which it is intended. Any superfluous weight has not only its effect on the motive power, but on the roadbed as well, and consequently makes a difference in the dividends at the end of the year.

A recent article by John C. Henry, contains some very valuable matter on this subject, in which he says in substance: The omnibus is constructed to shelter passengers and stand the vibrations incident to a rough road. They are built as commodious and light as possible. Sleeping cars are built to stand a high speed, to roll over embankments without breaking to pieces and to stand the kicks and jerks of a 1,000 horse power engine. The modern electric car is a cross between the two. In the construction of the street cars which are required to stop and start frequently, to lift themselves up steep grades, I think the lines of the omnibus should be observed, more particularly in the roof. If it is light, the walls and sides may also be. The city of San Francisco leads the way in mechanical street car traction. Their cars are admirably adapted for electric motors and are known as combinations. The earlier built were remodeled horse cars. The managers took the ordinary 14 foot horse cars, removed the platform and hood from one end and built a light 14 foot addition thereto. The new part was open with a passage way down the centre and the seats placed lengthwise, the passengers *facing outward*; these car bodies weigh about 7,000 lbs. and are mounted on light double 26 inch trucks. When mounted they weigh from 10,000 to 11,000 lbs. Their weight is distributed on eight wheels; taking the maximum estimate of their weight makes the weight on each wheel but 1,375 lbs. By adding a 30 horse power motor and placing it on the forward trucks, would give a pressure on the rail not to exceed 1,700 lbs. per wheel.

There are in many places to-day four wheel electric street cars that weigh empty not less that 10 tons, with a wheel pressure of 5,000 pounds, or almost twice that of a standard freight car. According to a law in mechanics this four wheel car injures the track seven times as much as the San Francisco style with motor. When the rolling stock is properly designed and the joint ties are supported on concrete, a 35 pound girder or T rail is all that is necessary for ordinary street railway purposes.

The combination car has nearly double the carrying capacity of the four wheeler referred to, and weighs nearly three and one-half tons less. If the estimate is correct, that it takes two cents per ton per mile to move this superfluous weight, and the mileage is but 100 per day, there would be a direct saving of seven dollars per day, which, multiplied by the number of cars and the average number of runs for a year, would make a large amount, representing the difference in the earnings of the road with the two styles of cars.

A SHORT-LINE TELEPHONE.

The Rabbidge telephone has been brought before the English public, according to London Lightning. This telephone, it appears, is designed for speaking over short lines, such as would connect the different rooms in a large warehouse or block of buildings. The usual call bell is replaced by a small vibrating reed in the receiver, which, when the circuit is closed, gives a clear note, pleasanter than the sound of a bell. A small tube containing mercury automatically changes the connections when the instrument is inverted. This stops the sound and acknowledges the call, which is made by removing a plug from one hole to another. The act of inverting the instrument also tends to prevent packing of the carbon granules in the transmitter. The whole is so small that it can be conveniently screwed to the side of a desk, thus saving the trouble of moving to an instrument fixed to the wall.

By means of two telephones, one with a diaphragm, the other without, the speed of machinery may be indicated at a distance. The telephone without the diaphragm is placed with the pole of its magnet very near the iron arms of a revolving wheel, or it is placed near a wooden wheel carrying a number of armatures. As the wheel revolves, the arms or armatures in passing the pole of the telephone produce changes of magnetism which induce electric pulsations in the winding of the telephone magnet. These electric pulsations affect the strength of the magnet of the distant telephone, thus causing the diaphragm to vibrate, producing in the telephone a musical sound, the pitch of which depends on the speed of the machinery. The pitch being ascertained by comparison with a pitch pipe or similar instrument, the speed is found by a very simple calculation.

SPARKS.

Mr Herman Bunker, of Barrie, Ont., has been granted a United States patent on a clutch pulley.

The purchase of an electric light plant is under consideration by the Council of the Town of Kamloops, B. C.

The village Council of Streetsville, Ont., have given a contract to the Reliance Mfg. Co., for six arc lights.

A by-law will be submitted to the ratepayers of Kincardine, Ont., on the 9th July, to authorize a loan of $10,000 for the purchase of an electric light plant.

The first shipments of material for the new switch-board for the Toronto office of the Bell Telephone Co., have been received from the factory in Montreal.

Acting in accordance with authority conferred by Parliament, the Bell Telephone Co., have decided to increase their captial stock from $2,640,000 to $3,168,000.

Owing to certain municipal regulations, the Chambers Electric Light and Power Co., of Truro N. S., have been compelled to reduce the height of their building to one story.

The Physical, Chemical and Mathematical Section of the Royal Society of Canada, has elected as its President, Mr. B. J. Harrington; Vice-President, Prof. H. C. Bovey, of McGill University; Secretary, Mr. G. Devill.

The town Council of Orillia have accepted the tender of the Canadian General Electric Co., for an incandescent lighting plant, at the price of $9,450, and the tender of Goldie & McCulloch Co., for steam plant, at the price of $2,750. The acceptance of these tenders is made contingent on the approval of the ratepayers of a by-law appropriating $13,000 for the purchase.

The Queen Victoria Niagara Falls Park Commissioners have granted to the Canadian Niagara Power Co., a perpetual franchise for the use of the water power of the Niagara Falls on the Canadian side of the river, and have formally accepted the plans submitted by the Power Company for the development of the water power. The site for an immense stone power house, similar in dimensions to the one on the United States side of the river, has been staked out on the side of the high bluff, under the Loretto Convent and Carmelite Monastery. The construction of the inlet canal, wheel pit and tail-race tunnel will be immediately commenced. The company expect to be in a position a year hence to supply 15,000 H. P.

TRADE NOTES.

The Canada Coals & Railways Co., Joggins Mines, N. S., are putting in a 300 horse-power Lancashire boiler, fitted with Galloway conical tubes. It was built by the Robb Engineering Co., who have another of the same size under constructoin for them.

The Johnston Electric Co. have opened offices at No. 34 York street, Toronto, as electrical contractors and dealers in electrical supplies. Their specialties are a new slow speed alternating current dynamo; a new arc lamp for alternating circuits, operated with or without transformer; a new automatic arc dynamo, direct constant current; railroad and stationary motors. Mr. W. A. Johnston, formerly manager of the Ball Electric Co., occupies a similar position with this new company.

PERSONAL.

At Cornell University, Commencement Day, June 21st, the degree of Mechanical Engineer was conferred on Messrs. W. F. McLaren, Hamilton, Ont., W. G. Krantz, Berlin, Ont., and J. H. Meikle, Morrisburg, Ont.; Thos. Hall, Washington, Ont., took the degree of Master of Mechanical Engineering.

The Hamilton, Grimsby & Beamsville Electric Railway Co., have appointed Wm. A. Sweet as their chief engineer. He comes to them highly recommended, having been employed by the Hamilton Vinegar Works Co. for the past four years. He is President of Hamilton Association No. 2, C. A. S. E., and a member of the Ontario Association of Stationary Engineers.

PUBLICATIONS.

With the June number the Arena opens its tenth volume, and is an especially notable issue. It contains over one hundred and seventy (170) pages.

An amply illustrated character sketch of Louis Kossuth appears in the May Review of Reviews. Besides portraits of Kossuth at various stages in his career, there are several reproductions of rare prints, representing battle scenes in the Hungarian revolution, which were suppressed at the time.

MONTREAL ELECTRIC CLUB.

The above Club, after having held a very successful series of meetings throughout the winter, have adjourned for the summer season.

SPARKS.

A metallic circuit is being constructed by the Yarmouth, N. S., Telephone Co.

Mr. Robt. Mainprize, of Wingham, will install an arc lighting plant at Goderich.

Mr. G. K. Nesbitt is installing additional electric plant in his mill at Cowansville, Que.

The extension of the North American Telephone line between Kingston and Smith's Falls, has been completed.

Incorporation is being sought for by the Stanstead, Que., Electric Light Co., with a capital stock of $25,000.

The ratepayers of London, Ont., are said to be in favor of accepting the company's recent offer for the construction of an electric railway.

A by law will shortly be submitted for the approval of the ratepayers of Collingwood, Ont., to authorize the expenditure of $12,000 for the extension of the waterworks and electric light systems.

The Bell Telephone Company have commenced the construction of their underground system at Ottawa. 18,000 feet of underground cable, and 19,000 feet of aerial cable, will be used. As the result of the use of these cables, the number of overhead wires will be greatly reduced in the central part of the city.

The St. John Street Railway Co., has recently elected the following officers: Sir Wm. C. Van Horne, president; Col. Tucker and Messrs. James Ross, H. P. Timmerman and H. H. McLean, directors, Mr. F. A. Warren, secretary-treasurer, and Mr. C. D. Jones superintendent. It is the intention to entirely re-construct and equip the new road with new material. The work will be commenced at once.

SPARKS.

The Brockville Light & Power Co. are applying for the contract to light the new asylum building. If their application is successful they will require a new alternator of at least 2000 lights capacity.

The Government are said to be looking out for a suitable site on the banks of the canal at Cornwall for an electric power station. When they have located one tenders will be required for the work.

The Reliance Electric Mfg. Co., referring to the paragraph in the recent issue of THE NEWS, which stated that an electric plant was required at Tilbury Centre, Ont., write that this statement is incorrect, as they put in a plant at that place in December last.

It is probably not widely known, says the N. Y. Electrical Review, that only seven out of the 17 transatlantic cables are now in use to having given out for various causes. Estimating the cost of each cable at $3,000,000, here is an irreclaimable investment of $30,000,000 safely buried beneath the ocean to a depth of from a few fathoms to over five miles.

There is one crudity about electrical work, says Power, which is perhaps more a problem for the electrician than for the engineer, and yet it is of interest from the power standpoint. A six hundred horse-power engine, for instance, is connected up to a six hundred horse-power generator. In case of an overload the engine could run up to eight or nine hundred horse-power, but when the electric load increases unduly the fuses blow or the circuit breakers drop, and that unit is dead until matters can be readjusted. It is as though a boiler were fitted with a fusible plug that would melt and put the fire out when the pressure got above the allowable limit. Cannot there be an electrical safety valve which will prevent a dynamo from furnishing over-much current without stopping it altogether?

POSSIBILITIES OF SPEED BY STEAM.

IN his recent inaugural address, the president of the French society of civil engineers, M. du Bosquet, pointed out that express trains daily attain seventy-five miles an hour on down grades, providing that such speeds are not dangerous. But the engines are not sufficiently powerful to maintain such speeds on a level. A drawbar pull which would give seventy-five miles an hour on a down grade of one in 200 would give only fifty-seven and a half miles on a level, and thirty-one and a fourth miles on up grade of one in 200. A slight increase in the average speed greatly increases the power required. If 322 horse-power will draw a train at fifty miles an hour up an incline of one in 200, for a speed of 125 miles 2,960 horse-power would be necessary. High speeds, moreover, increase the weight of the engines per horse-power, and there is a limit beyond which the engines could not move themselves. At their maximum power, the modern French locomotives weigh about 158 pounds per indicated horse power; but a similar engine of 150 tons generating 2,000 horse-power, would be required to draw a train of 100 tons up a slope of one in 200. The highest possible speed for such an engine and train up the slope would be eighty-seven and a half miles an hour, and for this the engine would weigh 670 tons and would generate 8,932 indicated horse-power.