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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. V.—No. 12.
DECEMBER, 1895
PRICE 10 CENTS
$1.00 PER YEAR.

CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL.

VOL. V. DECEMBER, 1895 NO. 12.

THE DETROIT BOILER EXPLOSION.

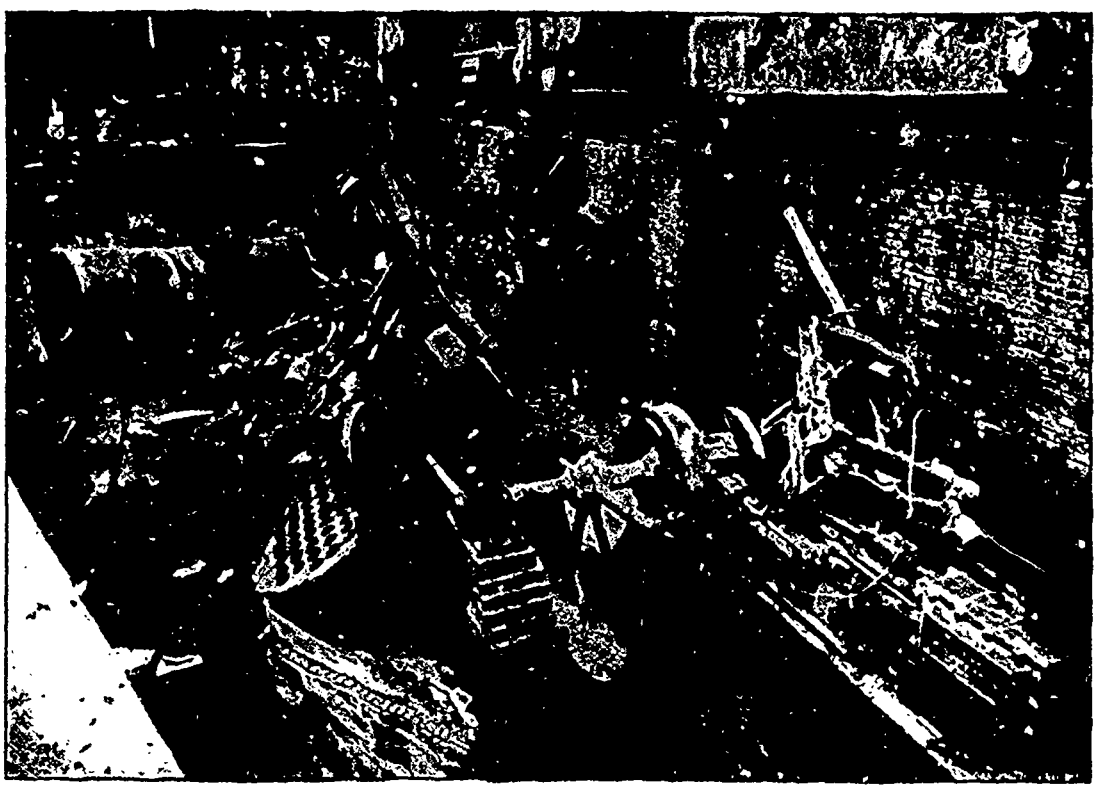
On the morning of the 6th November a steam boiler exploded in the Detroit Journal office, 45 and 47 Larned street west, by which 37 persons lost their lives and a number more were injured. The view we publish represents the scene of the disaster after all the debris had been cleared away, leaving, however, the boilers or parts connected with the boilers as nearly as possible in the position they were thrown by the explosion.

An investigation into the cause of the accident is under way, but the authorities have been very reticent and have endeavored to prevent any one from getting near enough to touch any part of the boilers, except those engaged in the investigation. This much, however, is known, there were two boilers of the ordinary horizontal tubular type in the basement of the building and set side by side. The fuel used was oil, injected into the furnaces by steam jets. The engineer had steam on one boiler at about 85 lbs. pressure supplying steam for the engine. The other boiler had its outlet valve closed, and steam was being got up in it, the intention being to use it, and to stop the other one for cleaning.

When the engineer left the boiler room some time before the explosion the boiler which exploded had 15 lbs. pressure on it, and the outlet for the steam not open.

The boilers had been frequently inspected by the Detroit City inspector, and were supposed to be sound and good boilers. The amount of damage done by the explosion of one of them seems to confirm this view. At the coroner's inquest on the killed the jury were instructed to bring in a verdict that death was caused by a boiler explosion. The engineer has been indicted for manslaughter and it is probable that the full results of the investigation will be made public at the trial.

There does not seem to be any need for any suggestion of mystery about the matter. The steam boiler was left with an oil fire under it, with no outlet for the steam, unless by the safety valve, and with 15 lbs. pressure on it. The pressure would rise rapidly, and as the fire was fed by oil forced in by the steam, it follows that the higher the pressure the fiercer the fire became.



THE DETROIT BOILER EXPLOSION.

The safety valve had either been too small or inoperative, and very soon the pressure became so great that explosion took place. From the fragments shown on the view it looks as if the cast iron manhole frame had given way first and the boiler had then torn into two sections. The other boiler was driven out of its seat into the wall, and was probably the cause of the fall of the building.

As showing how rapidly steam can be raised in a steam boiler, the test of the Merryweather fire engine

in Toronto might be cited. Of course it was a small boiler, yet it had only a small fire grate and burned ordinary soft coal. In it, when steam was being got up, it required 5½ minutes to get steam to 15 lb pressure from cold water, and only 4 minutes to raise the pressure from 15 lb to 100 lb, and only one minute to raise it from 50 lb to 100 lb.

At Detroit the oil would give a much hotter fire and there is no doubt the pressure rose with great rapidity after it once got past 100 lb.

THE G. T. R. SHOPS AT STRATFORD.

These shops, which a representative of the News recently had the pleasure of inspecting, are the main shops in Western Ontario to which "sick" engines are sent for repairs. In the machine shop two 78 h.p. engines run the greatest amount of machinery in one room in Canada. The "V" belt is greatly used here, and the superintendent, Mr. Barnet, took great pride in showing its merits. The belt is about four inches wide, with cleats of leather like a heel of a shoe, though in the shape of a V, cut off at the apex, rivetted on to the belt at intervals of six inches. The belt runs over concaved pulleys, and is said to be the best belt for use in places where it is necessary to run a vertical and a horizontal wheel with the same belt.

In the erecting shop, between two lines of locomotives in process of repair, is a track on which a traverser runs, being propelled by an endless chain in the centre of the track. When an engine comes in for repairs it is dead (i.e., no steam in it). The yard engine takes it in tow and shunts it on to the track which leads into the erecting shop. An engine (stationary) stands at the opposite side of the shops, and the engineer by pulling a cord sets the drum in motion; a rope from the drum is fastened to the dead engine and the drum pulls the engine into the shop on the traverser. By the engineer pulling another cord the engine allows four large chains to descend from the ceiling above the dead engine. Two large bars are then shoved through each pair of chains, and another cord is pulled, making the engine gradually raise the dead engine clear of its trucks. Then another of the cords is pulled, setting the endless chain in motion, which carries the traverser with the trucks to the end of the shop, where the trucks are unloaded for renovation, and wooden trucks placed on the traverser, which travels back to its former position. The dead engine is lowered on to the wooden trucks and the traverser carries it down to an empty track, where it is shunted alongside of its fellows on other tracks ready for repairs. All these different motions from its coming in till its going out are done with a little 25 h.p. engine.

Compressed air plays an important part in this part of the shops. The air is compressed in the boiler room. The engine in the boiler room is 75 h.p., and the piston rod runs clear through the cylinder into the cylinder of the air compressor, passing also through this, but when the rod comes out of the cylinder of the compressor it is hollow, to allow the air to enter the cylinder of the compressor. Air is brought in from the outside through a common tin pipe. The piston head in the cylinder of the compressor is hollow and is fitted with valves. As the rod recedes the valves close, and on its return stroke the air is compressed leading up through a pipe into an air main which extends all through the shops. Formerly when it was necessary to do machine work on any part of the dead engine, the part had to be taken from the engine to the machine, whereas now, by the use of compressed air, a little compressed air engine is run on wheels to the dead engine and the work is done right there. Another advantage of these little engines is that they are as well adapted to steam as to air.

A 14 in. steam main runs parallel with the air main the whole length of the shops, supplying 7 stationary engines and 3 immense steam hammers. The last part of the main shop is the boiler room, where the best machinery is used and where noise is a prominent feature. In another building is the carpenter shop and model room. The boiler tube room is one of the most interesting parts of the shop. When a locomotive's boiler tubes get so dirty that it is not economical to use them any longer, they are taken out and placed in a large cylinder, where scalding water and chemicals are forced through them, cleaning them out thoroughly. The ends have been damaged in taking them from the boiler, so they are heated and the ends sawed off, leaving burred ends. A man soon fixes that with the aid of a machine for the purpose. By reason of the ends having been sawn off, they have become somewhat short, and so are passed on to another man who has small pieces of tubing red hot. He slips a piece on each end and passes them on to another man, who welds them, when they are again ready for use.

An isolated building is used for the fitting of the tires on the driving wheels, gas being used to heat the rims. The boiler room and brass foundry are in another building. A battery of 9 boilers supplies the steam for the shops. The exhaust steam is led by pipes into a cistern in the boiler room, from which it is used over again. The boilers used are railway boilers and the ashes are drawn into a pit beneath the boilers.

A fire hall is one of the many useful institutions connected with the shops, and steam is at the steam pump at all times. A fire department is made up of the men and they are given occasional drill. If the city mains should give out by accident, a reservoir of 60,000 gallons is at hand, and by connecting the steam pumps with the nearest hydrant, a direct force of water can play on any part of the shops.

The large building on the street comprises the library, lounging room and manager's offices.

CORRECTION.

In the description of the long distance power transmission plant at Portland, Ore., published in our last issue, an error occurred in the last sentence of the first column on page 201. It should have read: "The four-wire system is worked at 133 volts between any two wires, and by means of feeder regulators a variation of 7½ in either direction is covered."

One of the severest wind storms for years prevailed over this continent on Nov. 26th. Telegraph, telephone and electric light wires were down in every direction, entailing great interruption to business and loss. The gale reached a velocity of 60 or 70 miles an hour in some places.

Chief Engineer Perry of the United States navey recently returned from a tour of 2,000 miles on the great lakes, made on the steamships Zenith City and Victoria, for the purpose of observing the working of the Babcock & Wilcox Scotch boilers. The Navy Department is considering the advisability of fitting the six new gunboats with these boilers, and engineer Perry was detailed to inspect them. His report will be favorable in both cases, and if the present plans of the department can be carried out three of the six new boats will have Scotch boilers and three the Babcock & Wilcox.

THE TRENTON-BELLEVILLE TRANSMISSION PLANT.

THE power transmission plant now being installed at Trenton will be in point of distance over which the power is to be transmitted the most important work of the kind so far undertaken in Canada. The valuable water power of the Trent river developed at a large outlay some years ago will be utilized to furnish power and light for Trenton and also for the city of Belleville, located at a distance of 12 miles from the generating station. Such a scheme would, only a year or two ago, have been regarded as chimerical both from an engineering and commercial point of view, but the rapid development of the alternating induction motor from a laboratory toy into an everyday industrial implement, has made possible for this and many similar undertakings an immediate operating and commercial success.

The Trenton Electric Co., of which Mr. W. H. Pearson, jr., of Toronto, is the moving spirit, has under its control, including the power rights leased from the town, something like 1,000 horse power. A new power house is being erected and water wheels installed having a capacity of 500 horse power. For the transmission plant, after a careful consideration of the merits of the different systems offered, the three-phase system of the Canadian General Electric Co. was selected, and a contract closed with them for the necessary apparatus.

The initial installation will consist of two 150 kilowatt three phase alternators, from which currents at 2000 volts will be taken direct for the Trenton end and distributed by means of secondary mains for incandescent lighting and power. For the Belleville end the current will be raised through step-up transformers to a potential of 10,000 volts, the loss due to ohmic resistance at this voltage being at full load less than 3 per cent. At the Belleville sub-station step-down transformers will supply current to the mains for distribution at 2000 volts, and the larger motors will be wound to take current at this pressure direct.

Arrangements have been completed for operating the waterworks, for which two fifty horse power induction motors will be used. A 50 horse power motor will probably be installed to drive the series arc light dynamos now supplying the city circuits. It is expected that a contract will be made later on with the Belleville Street Railway Co. to furnish power for their system, now operated by steam.

The entire supervision of this important electrical engineering work has been placed in the hands of Mr. J. M. Campbell, of Kingston, who has been prominently identified with most of the larger railway and lighting installations in eastern Ontario, and in whose hands we may expect the various novel and interesting applications of electric power contemplated in connection with this transmission will receive the most careful theoretical and practical treatment.

Mr. Pearson and his confreres in the Trenton Electric Co. are certainly deserving of every success for their enterprise in this notable step towards the utilization of one at least of the many valuable water powers now lying idle throughout Canada.

THE Chicago Times-Herald race for motocycles, or horseless vehicles, postponed from November 2nd, took place on November 28th, under very unfavorable weather conditions, as the machines had to plough through slush and snow. Full particulars have not come to hand, but the contest was won by the Duryea machine.

WESTERN ONTARIO ELECTRIC PLANTS.

WE continue our notes of western Ontario electric plants, commenced in last month's issue:

CITY OF WINDSOR LIGHTING PLANT.

This plant is situated on Pellissier street, in the heart of the city and is owned and controlled by the City of Windsor. The chief engineer is Mr. Thos. Chater. The building is a one-story brick building, L. shaped. The engine room is 30 × 60 and the boiler room 40 × 25. In the boiler room are two Leonard boilers of 100 and 65 h. p. respectively. Room is left for two more boilers. In the engine room is a 150 h. p. Leonard Ball engine *driving onto a line of shafting of 27 feet. Off this shafting* run 4 arc machines, 3 of the Reliance system and one Waterford, each of 50 lights capacity.

The switch board is 9 × 15, built to accommodate increasing demand, 22 miles of wire are used for the 175 arcs and 75 fifty c. p. incandescent lights. There is no better arc light plant in Canada than this.

SARNIA ELECTRIC AND GAS LIGHT PLANT.

The electric light building is a large red brick building with a commodious basement under the engine room, the floor of which is supported by massive brick piers.

In the engine room is a Wheelock engine of 75 h. p. running two C. G. E. Co.'s machines one a 500 light alternator, with exciter, the other a 1200 c. p., 75 light, Wood arc machine. These machines are regulated by a switch board to each machine, the alternator having a skeleton C. G. E. and the arc machine a similar make fixed to the wall behind the skeleton switch board. Two hundred lights will be required for the new hospital, thus calling for another alternator, and a railway motor is proposed to supply power to the street railway when they change their motive power, which is now horse.

The boiler room is built to accommodate two more boilers, only two being now in use. Coal alone is used for fuel. The basement is used as a storage room, and a Northey condenser will soon be put in place there. *On the walls of the engine room are the charts* of the light system through the town, together with blue prints, photos and numerous glass cases of stuffed birds and small animals. Mr. Shand, the chief electrician, is a great student of natural history, and is an expert taxidermist, doing all his own work. A friend presented him with a "Corry's bittern" a rare species of bittern only two more having been shot in Ontario.

The gas house is a large building behind the electric plant and supplies a great number of consumers. A short time since an explosion took place in the purifying room, which blew the *roof off to a distance of 40* feet. The buildings are heated by gas, and electricity is used in lighting.

Small machines for repairing are driven from the shafting, and Mr. Shand does all the repairing.

The manager, Mr. W. Williams, has had a long experience in the gas business, but is pushing electric lighting for all it is worth. He has got out an account book suitable to gas or electric lighting, and the Western Gas Association on seeing it had it published, and it is now used by a great many gas companies. It can be used for either a gas or an electric meter. It needs but be seen to know its value.

A new style of heater has been introduced into the street cars at Kingston. It is flush with the seat and does not project into the car. It is the design of Mr. Jas. Halliday, electrical overseer of the Kingston Street R. R. Co., who will apply for a patent.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE. Secretaries of Associations are requested to forward matter for publication in this Department not later than the 25th of each month.

TORONTO ASSOCIATION NO. 1.

The ninth annual dinner of the above Association took place at the Richardson House on the evening of Wednesday, Nov. 20th. The attendance was greatly in excess of any previous occasion so great, in fact, that the large dining hall was not sufficient to allow of all the guests being seated together at the tables. There were three tables extending almost the entire length of the room, with a fourth across the upper end; these were tastefully decorated with foliage plants, etc.

Mr. Lewis, President of the Association, a portrait and sketch of whom is presented with this report, was the presiding officer, and fulfilled in a most creditable manner the duties of the position. On his immediate right sat Professor Galbraith, Principal of the School of Practical Science, and Dr. Orr, Chairman of the Toronto Technical School Board; and on his left, Mr. John Galt, C.E., and Mr. A. B. Smith, President of the Canadian Electrical Association. Among the other guests were the following:

TORONTO.

J. E. Cameron.	J. N. Lambert.
A. E. Edkins.	A. McBean.
A. Travis.	J. W. Marr.
J. Thompson.	Geo. Fowler.
A. Thomson.	A. J. McDonough.
C. Heal.	Lawrence Farrell.
J. Moat.	E. J. Philp.
J. Hall.	Wm. Butler.
J. Bannom.	E. Ash.
J. McLaughlin.	W. Bundy.
J. Ewing.	G. W. Grant.
T. Hobbs.	J. Richardson.
J. Wilson.	S. Thompson.
J. Mountstephen.	G. T. Pendrith.
A. C. W. Soper.	W. P. Despard.
Wm. Ablbs.	C. Sodden.
A. G. Horwood.	W. T. Blacklock.
C. H. Mortimer.	G. A. Enouy.
James M. Sinclair.	T. Seaton.
B. Doyle.	D. Bowman.
T. Long.	T. Cadwell.
John Fox.	R. J. Donchay.
Alex. Robertson.	Fred. Day.
J. Bliss.	John McCleary.
J. W. Ball.	R. S. Brown.
F. S. Jackson.	John Day.
R. H. Smith.	S. Galbraith.
S. Bassett.	R. Owen.
G. A. Perry.	J. Wadge.
D. McCulloch.	E. Arscatt.
Robt. Hutt.	H. H. Tait.
J. H. Pringle.	W. P. Sutton.
H. C. Mills.	Jas. Mooring.
W. J. Burroughes.	J. B. Millar.
J. Smith.	Geo. White.
Jas. Mullin.	Geo. Gilchrist.
John Long.	E. Appleton.
J. J. Ramsay.	John Campbell.
Wm. Donaldson.	Wm. McKittrick.
A. McMartin.	Wm. McIntyre.
S. H. Fussell.	N. V. Kuhlman.
Edwin Farrants.	J. F. Ross.
E. B. Biggar.	A. Townsend.
W. J. Hannan.	W. Eames.
G. C. Mooring.	J. Grainger.
F. J. Smith.	Alf. Butcher.
Thos. Reid.	Chas. Pearce.
Chas. Smith.	T. Philip.
Albert Forrester.	W. Good.
Wm. Sutton.	H. Buehner.
W. W. Mason.	G. B. Towers.
G. F. Spry.	T. Hope.
Robert Flint.	Wm. Vaughan.
Joseph Kirk.	W. Phillips.
C. J. Read.	A. M. Wickens.
Benj. Flint.	

OUTSIDE GUESTS.

James Webb, Hamilton. B. Crandell, Toronto Junction.
Joseph Craig, Oshawa. W. Oathwaite, Peterboro'.
J. Queen, Toronto Junction.

The menu, which was artistically printed, was as follows:—

FORMULAE

Hydraulic SOUP—A la Keating.
Celery.

FISH

Steam Boiled—cup—Clinker Sauce
Scales Removed by Sutton's Compound.
Pommes Parisienne Bread and Butter Fritters.

OILTRAYS

Gusset Stays of Lamb. Chicken Croquettes.

Double Butt Straps JOINTS—Triple Rivetted.
Roast Turkey. Frame of Beef.
Water Leg of Mutton. Yorkshire Pudding.

VEGETABLES

Potatoes all Broke Up. Corns. Stewed Tomatoes.

ENTREMENTS

English Plum Pudding, High Potential Sauce.
Apple Pie. Cut-Off Pie. Wood-Raspberry Tart.

DESSERT

High Celery. Cheese. Biscuits. Assorted Cakes.
Volts and Amperes.
Figs Dates. Apples. Bananas. Oranges.
Watts.
Tea. Coffee. Lemonade. Georgian Bay Water.
Claret. Sherry. Pale Ale. Ginger Ale.
Electric Shocks. Compound Wound Cigars.

After the Chairman had read a number of letters of regret from persons who could not be present, the company proceeded to do justice to the contents of the tables. The toast list was then proceeded with. It bore the following inscription:

And the truant husband will return and say,
"My dear, I was the first to come away."

After listening to a piano solo by Mr. Harding, the national anthem was enthusiastically sung in response to the toast of "Her Majesty the Queen."

In response to the toast of "Canada our Home," the company were favored with songs by George W. Grant and Mr. Wright.

Mayor Kennedy arrived just in time to respond on behalf of the city of Toronto. He made reference to the objects of the Association, to the duty incumbent on men to help each other in life, and to the advantages to be derived from union of effort. He enlarged upon the greatness of the British Empire, stating that this greatness was in a large measure due to the application of steam and the steam engine, in driving British ships of commerce over all seas.

Messrs. Smith, Brett and Martin responded on behalf of the toast to "The Manufacturers."

After a song by Mr. Seaton, the chairman proposed the toast, "Educational Interests," coupling therewith the names of Dr. Orr and Professor Galbraith.

Dr. Orr, in responding, pointed with pride to the city of Toronto as a centre of education, and to the fact that graduates of Toronto University might be found holding leading positions in all parts of the world. Education in Toronto, he said, was as free to the son of the poor man as of the rich man. Referring to the Toronto Technical School, with which he was more particularly connected, he remarked that the public do not appear to clearly understand what the school is, and what it is for. The creation of the Toronto Technical School was almost entirely due to the Association under whose auspices they had met. The late Mr. Wills, Mr. A. M. Wickens, and the late Alderman Gillespie, were the foremost promoters of the institution. The by-law under which the school was founded was drafted by Messrs. Wickens and Wills, and afterwards revised by Professor Galbraith, who had from the beginning been a staunch friend of the institution. The school had now an excellent staff of teachers, and its popularity was attested by the fact that the attendance had increased from two hundred to six hundred. He would like to see a trade school added to the present institu-

tion a school in which young men who were fitted to become mechanics would have the opportunity of receiving the instruction which they require, and which it was impossible for them to obtain in the workshops of to-day, on account of the extent to which the various branches of manufacturing had become specialized. The school had much to thank the City Council of Toronto for, inasmuch as all the funds required for its support were derived from that source. He had only one complaint to make, which was that the Mayor and Aldermen had not attended the school as frequently as the Board could wish. In conlusion, he wished Toronto Association No. 1 continued prosperity.

Professor Galbraith compared the present gathering with the first one of the kind at which he was present, when the attendance was not more than one-fourth of that of the present occasion. He facetiously remarked that this was an evidence that the Association, although composed of stationary engineers, was by no means "stationary," but very much alive. He then proceeded to define the difference between professional and technical education. The minister, he said, lives on the moral evil that is in the world; the doctor on the physical evil, etc., but the engineer would do better if there was no evil in the world at all. Technical education is the education of men engaged in turning the material resources of the world to advantage. He turned aside to repeat a story which Mr. William Sutton is said to be the author of. It ran thus: A country engineer dropped into the engine room of a Toronto engineer, and was shown an indicator card something which he had never seen before. He enquired what it was for, and was told that the card was drawn by the engine. The country engineer's face showed incredulity, and he immediately went round the corner and told another engineer that "a bloke had tried to make him believe that his engine could draw." Referring to the Toronto Technical school, the Professor said that the success which had attended the institution had exceeded all expectations. The students had shown, by the manner in which they had stuck to their work, that they had their educational interests at heart, and upon this the success of the school depends. He had no hesitation in saying that the school would grow, and that the City Council would find it necessary to pay more and more attention to it.

After a song by Mr. McLean, Mr. E. J. Phillips, in the absence of Mr. W. G. Blackgrove, the President, responded to the toast of the "Executive Council." A few years ago, he said, it would have been impossible to find a single engineer who could figure out the strength of a double butt strap joint, triple rivetted, but to-day there were in the ranks of the Association quite a number of men who could do this, while others who a few years since could not figure at all, could now solve any ordinary mathematical problem. During the recent hard times the Association of Stationary Engineers had added a larger number of new members to its membership, and had had better attended meetings than any other society with which he was acquainted. The skill of the boiler maker was of little value, if his work was placed under the care of an incompetent engineer. In conclusion, he expressed gratitude to Prof. Galbraith and Mr. John Galt, whose knowledge had always been placed at the disposal of members of the Association.

At this juncture Mr. George Grant sang, "We're a' John Tamson's Bairns."

In response to the toast, "Sister Societies," Mr. A. B. Smith extended fraternal greetings on behalf of the Canadian Electrical Association. While he did not think that engineers need lose any sleep over the prospect of electricity displacing the steam engine, yet it was hard to predict what the future might have in store. The developments in electricity thus far had shown that a "something" had been introduced which was as swift as light, which never freezes, never breaks, and can turn corners.

Mr. Bliss responded on behalf of the Amalgamated Society of Engineers. This society was composed of mechanics and engineers, and had upwards of 80,000 members in good standing. The receipts last year were $1,220,000, and during the last forty-one years the sum of $561,000 had been expended in assisting other organizations to maintain their rights.

The last toast on the programme was that of "The Press," which was responded to by Mr. Biggar, of the Canadian Engineer, and C. H. Mortimer, of the ELECTRICAL NEWS.

The Committee of Management, to whose efforts this very successful dinner is due, was composed of Mr. E. J. Phillips, Chairman; G. S. Mooring, Secretary-Treasurer; Samuel Thomson, James Huggett, Wm. Eversfield and A. E. Edkins.

MR. WALTER LEWIS.

Mr. Walter Lewis, president of Toronto Association No. 1, C. A. S. E., is quite as good looking as his portrait which we have the pleasure to present to our

MR. WALTER LEWIS.

readers, and possesses the geniality combined with firmness and executive ability necessary to the successful discharge of the duties of a presiding officer.

Mr. Lewis was born in Chatham, England, 37 years ago, and came to Canada when only seven years of age. He has been a resident of Toronto for twenty years, during which time he has filled positions with Messrs. Neil & Sons, engine builders, H. E. Clarke & Co., the Toronto Silver Plate Co., etc. On resigning his position with the last-named company he was presented with a valuable gold chain by his employers, in recognition of the ability and faithfulness with which he discharged his duties during the seven years he was in their service. He now occupies a responsible position as engineer at the High Level Pumping Station of the Toronto waterworks.

Mr. Lewis was one of the organizers of Toronto Association No. 1, and gave proof of his ability in several minor offices before being elected to the president's

chair. His rule of conduct is best expressed in his own words, as follows: "Since making up my mind to be an engineer I have always tried to study what would be useful to me in that trade or profession, and have tried to help any one in the trade who at any time required a helping hand, recognizing the fact that while one is helping others he is benefitting himself also, and that we are never done learning, for no sooner do we master an old thing than a new one comes along."

MONTREAL NO. 1.

The Montreal branch of the C. A. S. E. is preparing for a vigorous winter's campaign. They have already done good work in an educational way, and this season promises better results than ever. They have made arrangements for practical demonstrations on subjects of interest, and for the reading of papers, at which all engineers will be invited to be present.

At their last meeting Mr. Peter McNaughton read a paper on "Evaporation in Steam Boilers and in Nature," the point being that the action of the steam boiler is identical with the process of nature, and that the use of steam is but applying nature's law to practical purposes. Mr. J. J. York gave a demonstration on the blackboard of the heating surface and horse power of a Lancaster boiler.

COMBUSTION.*

By Thomas Wesley, Ottawa.

Combustion is the energetic chemical combination between the oxygen of the air and the constituents of the combustible, and the value of any fuel is measured by the number of heat units which its combustion will generate, a unit of heat being the amount required to heat one pound of water one degree Fahrenheit. This fuel chiefly used to generate the heat consumed by steam engines is coal and wood, the component parts of which are carbon, hydrogen and ash, with sometimes small quantities of other substances not materially affecting its value. The combustible is that portion which will burn, and, in the combustion of coal, carbon is the principal substance that unites with oxygen, and the air is the source from which oxygen is derived.

Coal has been divided into two primary divisions, viz., anthracite, or hard coal, and bituminous, or soft coal. Anthracite contains a very small portion of volatile matter, but is nearly pure carbon, ranging from 85 to 94 per cent., and burns almost without flame. The term anthracite is never applied to coal containing less than 82 per cent. of carbon. The usual components of soft coal are bituminous volatile matter, coke and ash, as a mechanical separation, but chemically the constituents of coal, though varying in quality as well as degree, are chiefly carbon and hydrogen gas, combined occasionally with a small proportion of sulphur and incombustible matter. The proportion of carbon in this coal varies: in good coal it is seldom less than 75 per cent. of the whole, sometimes considerably more. Not only do the different kinds of coal differ in their constituents, but coal from the same seam will vary considerably from the normal standard of that coal.

From a scientific analysis, by Professor Liebeg and other eminent chemists, it has been shown that in soft or bituminous coal there is about 80 per cent. of carbon, 5 per cent. of hydrogen, 10 per cent. of azote and oxygen, and 5 per cent. of ash, varying with the different kinds. The principal constituents of all coals, carbon and hydrogen, are united and solid in its natural state, and are essentially different in their character and in their modes of entering into combustion.

The theory of combustion is well understood by scientists, but in practice the art of burning coal economically, and of converting all its natural elements into heat and power, is but little understood. It is also a well known fact that carbon and hydrogen require certain quantities of atmospheric air to effect their combustion, yet, in practice, the means necessary to find out what quantity is supplied, is generally neglected and treated as though it was of no importance.

The bituminous portion of coal is convertible into heat in the gaseous state alone, and then only in proportion to the right mixture and union effected between them and the oxygen of the air, while the carbonaceous portion is only combustible in its solid state, and neither can be consumed while they remain united. To obtain combustion they must be separated, and a new union formed with the oxygen of the air. In combustion there must be a combustible and a supporter of combustion, which means chemical union, and oxygen is this supporter. In fact oxygen is just as essential in combustion as it is in the maintenance of life in the animal kingdom.

You all know from experience that putting on a fresh supply of coals on the furnace, they do not immediately increase the general temperature, but, on the contrary, become the absorbent of heat, the source of the volatilization of the bituminous portion of the coal; and until these constituents are evolved from it, its solid or carbonaceous part remains black, and at a comparatively low temperature. Now volatilization is the most cooling process of nature, by reason of the quantity of heat directly converted from the sensible to the latent state.

On the application of heat to bituminous coal the first result is its absorption by the coal, then follows the liberation of its gases, from which flame is exclusively derived. These gases are composed of carbon and hydrogen, and the union is known as carburetted hydrogen and bi-carburetted hydrogen. Carburetted hydrogen by itself is not combustible, but must be united with oxygen, and notwithstanding the strong attraction which exists between them, they will not rush together or enter into chemical union, which we call combustion, until they have been raised to a certain temperature, and this temperature, according to Sir Humphry Davy, should not be under 800 degrees Fahrenheit, since below that flame cannot be produced or maintained.

The first essential to effect the combustion of gas is to ascertain the quantity of oxygen with which it will chemically combine, and the next the quantity of air required to supply the necessary quantity of oxygen. Now while this may be well understood and correctly arrived at by an expert chemist in his laboratory, we know that in the management of combustion in the furnace the ordinary engineer can at best only approximately apply the exact laws of chemistry to the very imperfect conditions found at every furnace. It is important, however, that every engineer in charge of a steam plant should at least understand theoretically the analysis of the elements with which he has to deal in producing combustion, and the proportional part of each element entering into the same.

According to chemical analysis an atom of hydrogen is double the bulk of carbon vapor, but the latter is six times the weight of the former. (Atom in modern scientific usage is the smallest portion into which matter can be divided. The chemists unit. In chemistry two atoms of hydrogen and one atom of oxygen make a molecule of water.) Again, an atom of hydrogen is double the bulk of an atom of oxygen, yet the oxygen is eight times the weight of hydrogen. So of the constituents of atmospheric air, which is a mechanical mixture of nitrogen and oxygen, not in chemical union, but simply shaken up together. These constituents, nitrogen and oxygen, are mixed in the proportion of 79 parts of nitrogen to 21 parts of oxygen out of every 100, and by weight 77 lbs. of nitrogen to 23 lbs. of oxygen, or one pound of oxygen to every 3·3478 pounds of nitrogen.

To accomplish the combustion of six pounds of carbon, sixteen pounds of oxygen are necessary, forming 22 lbs. of carbonic acid gas, which will have the same volume as the oxygen, and therefore a greater density, and to accomplish the combustion of one pound of hydrogen, eight pounds of oxygen are required. When therefore we know the proportions of carbon and hydrogen existing in coal it is easy to tell the quantity of oxygen, and consequently the quantity of air necessary for combustion.

As a general rule it may be stated that for every pound of coal burned in a furnace about twelve pounds of air, or 150 cubic feet, will be necessary to furnish the oxygen required, even if every particle of it entered into combustion. But from careful experiment it has been found that in ordinary furnaces about as much more air will in practice be necessary, or about 24 lbs. per pound of coal burned, since, besides the air required to furnish the oxygen necessary for the complete combustion of the fuel, it is also necessary to furnish an additional quantity for the dilution of the gaseous products of combustion. Now one cubic foot of air, at a temperature of 40 degrees, weighs ·08 of one pound, and it requires 12½ cubic feet of atmospheric air to equal one pound in weight, and each pound of air contains 3.68 ounces of oxygen, and it will take 1,200 pounds or 15,000 cubic feet of air for the perfect combustion of 100 pounds of coal. We thus perceive that each pound of coal requires 150 cubic feet of air for its perfect combustion, or in other words, for the conversion of its carbon into carbonic acid, and all

* A paper read before the Canadian Association of Stationary Engineers.

its hydrogen into water, and it must be remembered that just in proportion as this proper quantity is deficient, combustion is imperfect and fuel wasted.

Air expands or contracts an equal amount with each degree of variation in temperature, and its weight and volume for any condition of temperature and pressure may be found by the following formulae, which are nearly exact :—

$$\text{Weight} = \frac{2{\cdot}71 \times \text{Pressure in lbs. on the barometer.}}{\text{Absolute temperature.}}$$

$$\text{Volume} = \frac{\text{Absolute temperature.}}{2{\cdot}71 \times \text{Pressure on barometer in lbs.}}$$

$$\text{Absolute temperature} = 460 + \text{temperature shown on thermometer.}$$

$$\text{Pressure in lbs. on barometer} = \frac{\text{Height in inches.}}{2{\cdot}0408}$$

It is erroneously supposed by some that when no smoke appears at the chimney top, combustion is perfect ; smoke, however, may be absent, yet the carbon may have only united with one atom of oxygen forming carbonic oxide (a colorless gas), instead of with two atoms forming carbonic acid, and consequently have only performed half the duty as a fuel of which it was capable, and this loss is constantly going on in all furnaces where all the air has to pass through a body of incandescent carbonaceous matter.

The air on entering from the ash pit gives up its oxygen to the glowing carbon on the bars, and generates great heat in the formation of carbonic acid, and this acid necessarily at a very high temperature, passing upwards through the body of incandescent solid matter, takes up an additional portion of carbon and becomes carbonic oxide. By the conversion of one volume of carbonic acid into two volumes of carbonic oxide, heat is actually absorbed, while the carbon taken up during such conversion is also lost. The formation of this compound, carbonic oxide, is attended by circumstances of a curious and involved nature, and is probably the cause that, in actual practice, so little is known about it. The direct effect of the union of carbon and oxygen is the formation of carbonic acid. If, however, we abstract one of its portions of oxygen, the remaining portions would be carbonic oxide, and it is equally clear that if we added a second portion of carbon to carbonic acid the same result will be arrived at, namely, have carbon and oxygen in equal proportions, as we have in carbonic oxide. By the addition of still another portion of carbon, two volumes of carbonic oxide will be formed, and if these two volumes of oxide cannot find the oxygen necessary to complete their saturating equivalents, they pass away but half consumed.

Another important peculiarity of carbonic oxide is, that by reason of its already possessing one-half of its equivalent of oxygen, it inflames at a lower temperature than the ordinary coal gas, the consequence of which is that the latter, on passing into the flues, is often cooled down below the temperature of ignition, while the former is sufficiently heated, even after having reached the chimney top, and is there ignited on meeting the air. This is the cause of the flame often seen at the top of chimneys or the funnels of steamships.

If we could gather and retain the carbonic acid gas which is daily discharged by tons from the chimneys of our factories, we should still have all the carbon of our coal, but we could not do it, because it would take as much power to separate the carbon from the oxygen as they gave out in the form of heat in coming together, and here comes in one of nature's most wonderful and mysterious processes.

It is a peculiar function of vegetation that under the influence of sunlight it can overcome the attraction which exists between the atoms of carbon and oxygen, appropriating the carbon to its own use, building it into its structure and letting the oxygen go free into the atmosphere, not with a noisy demonstration or prodigious effort, but quietly in the delicate structure of a green leaf moving in the sunshine.

When all the conditions belonging to the introduction of air to the two distinct bodies to be consumed, carbon and hydrogen, have been complied with, there should be very little difficulty in securing perfect combustion in the furnace. But as a rule, these conditions are not complied with, hence the great waste in fuel. If we would economize fuel, we must give attention, not only to the mechanical appliances, but also to the nature of the bodies we have to deal with, their constituent parts and chemical relations respectively, and as the laws of nature are inexorable, mechanical details must yield to those of chemistry.

Great strides have been made in improvements in the boilers and engines now on the market, but until recently scarcely any attention has been given to the grates and furnace, practically overlooking the fact that the furnace, in which the operations of combustion are carried out, is of the first importance, as it is here we have the real source of economy and power.

In regard to the proportions of the furnace, we have to consider the area of the grate bars for the holding of the solid fuel, and the kind best adapted to our purpose (some people think that anything will do for a grate that will stand up under hot fires), the size of the air spaces, and the means of keeping these air spaces clear of obstruction to the draught ; then the sectional area of the chamber over the the fuel for the consuming of the gaseous portion of the coal and the introduction of oxygen to this chamber.

The rule in practice to-day with our best fire-tube boilers, the horizontal return tubular, is to allow 15 square feet of heating surface per horse power, and by dividing the horse power by three, we obtain our grate surface in square feet, allowing 68 square inches of air space per square foot of grate.

Strictly speaking, there is no such thing as "horse-power to a steam boiler, as it is a measure only applicable to dynamic effect. But as boilers are necessary to drive steam engines, the same measure applied to steam engines has come to be universally applied to the boiler, and cannot well be discarded. In consequence of the different quantity of steam necessary to produce a horse power, with different engines, there has been great need of an accepted standard by which the amount of boiler required to provide steam for a commercial horse power may be determined. This standard, as fixed by Watt, was one cubic foot of water evaporated per hour from 212° for each horse power. This was at that time the requirement of the best engines in use. At the present time Prof. Thurston estimates that the water required per hour, per horse power, in good engines, is equal to the constant 200, divided by the square root of the pressure, and that in the best engines this constant is as low as 150. This would give for good engines working with 64 pounds pressure, 25 pounds water, and for the best engines working with 100 pounds, only 15 pounds water per hourly horse power.

The extensive series of experiments made under the direction of C. E. Emery, M. E., at the Novelty Iron Works, and published by Professor Trowbridge, show that at ordinary pressure, and with good proportions, non-condensing engines of from 20 to 300 horse power required only from 25 to 30 lbs. water per hourly horse power in regular practice.

The standard, therefore, adopted by the judges at the Centennial Exhibition of 30 lbs. of water per hour, evaporated at 70 lbs. pressure from 100° for each horse power, is a fair one for both boilers and engines, and has been favorably received by both engineers and steam users. But as the same boiler may be made to do more or less work, with less or greater economy, it should be also required that the rating of a boiler be based on the amount of water it will evaporate at a high economical rate. For the purposes of economy, the heating surface should never be less than one and generally not more than two square feet for each 5,000 British thermal units to be absorbed per hour, though this depends somewhat on the character and location of such surface. The range here given is believed to be sufficient for the different conditions in practice, though a far greater range is frequently employed. Square feet of heating surface is no criterion as between different styles of boilers—a square foot under some circumstances being many times as efficient as in others—but when an average rate of evaporation per square foot has been fixed upon by experiment, there is no more convenient way of rating the power of others of the same style.

(To be Continued.)

One of the old timers in Canadian telegraphy died recenty in Hamilton, in the person of Mr. Charles Jamieson, a lineman on the G. N. W. He entered the service of the Montreal Telegraph Company about 1850, and about 1856 was stationed at Prescott, from where he removed to Hamilton in 1857, remaining there ever since. He worked on the first line erected in Canada, the old Grand Trunk. His death was caused by pneumonia, arising from exposure.

The escape of gas has always been a source of loss and deterioration in the curing of champagne, and no system of perfect air-tight sealing was known. Electricity has come to the aid of the champagne makers, and a system of electrical sealing has been discovered, by which the cork and part of the neck of the bottle are covered with a thin layer of copper. The process is simple and answers its purpose to perfection. It can be extended to the sealing of all kinds of bottles and jars.

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

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THE sixth year of publication of THE ELECTRICAL NEWS comes to a close with the present number. An index to the contents of this volume is presented herewith. At the commencement of a new volume and a new year, we may have a few words to say with regard to the progress achieved. Meanwhile, we heartily extend to every reader best wishes for a Happy and Prosperous New Year.

THE Grand Trunk Railway has adopted the block system of running its trains, an important step, but one which will afford much satisfaction to its patrons, in that it provides, *if faithfully carried out, against all* possibility of accident from collisions, either front or rear. The change will necessitate the employment of a large additional staff of telegraph operators.

A CONVERSATION which the writer had recently with a Toronto man who had just returned from Europe, goes to show that in "Lunnon" *there should exist the* most profitable field in the world for electric lighting. The atmosphere is described as being at times so thick with fog that it can almost be cut into slices, and the stranger who ventures beyond his doorstep requires the assistance of a native or policeman to enable him to locate himself.

THE Toronto Globe satirizes thus the visionary scheme of the Georgian Bay Power Canal promoters: "A project is on foot to utilize the water power of the Humber River. It and other channels drain an area of, by the estimate, 562 square miles. The yearly rainfall on this is about twenty inches, and if it were all caught in pails, buckets and barrels and carried to an effective situation, it could be used to make a water power truly gigantic."

MR. James Milne is making a great success of the Electricity Class at the Toronto Technical School. The present membership of the class is said to be about 160. Mr. Milne is the only teacher at the school who has had the benefit of a technical school training. It is not altogether surprising, therefore, that possessed of this advantage, in addition to excellent natural ability, he should have proved himself to be exactly the right man in the right place.

A CURIOUS fact in connection with the growth of electric street railways was brought out at a recent meeting of the corporation of McGill University at Montreal. The deans of the different faculties reported the number of students as 1193, there being an increase in all except that of veterinary science. Dr. McEachren explained the decrease in this subject by the fact that the displacement of horses by electricity for street car purposes had greatly reduced the business of veterinary surgeons.

THE London, Ont., Street Railway Co., after the introduction of electricity on their lines, adopted a somewhat ingenious means to surmount a difficulty which confronted them. The C. P. R. objected to the street company crossing their tracks, and the permission of the Privy Council at Ottawa has to be obtained, which takes time. The right to cross with horses still existed, so the cars were run up close to the C. P. R., where horses were attached to draw them across, when they proceeded on their way with electricity.

PERHAPS we may see the day when dynamos will be done away with and electrical power be drawn from nature's huge dynamo—the earth. Prof. Bigelow, of Washington, suggests the idea that the earth acts as the armature of a great dynamo, and by revolving in the sun's magnetic field generates the so-called earth currents of electricity. Mr. Lang points out how, by wrapping the earth with a suitable system of conductors, power could be obtained, and he even goes into a calculation how much it would be. The only difficulty is the enormous cost of the plant. Perhaps that can ultimately be surmounted.

THE Street Railway Review, of Chicago, assumes responsibility for the statement that the ladies of Montreal ignored their American sisters who attended the recent street railway convention. Our contemporary says: "The ladies turned out in good force, and made the best of the situation in entertaining themselves; for as usual their escorts could give but little time. One could but recall the glorious hospitality of the resident ladies of Washington, Milwaukee, Cleveland, Buffalo, and elsewhere." What have the Montreal ladies, or those who should be their spokesmen, to say in answer to the charge? It can at least be said that the attendance at the business sessions during the convention was slim enough to warrant the inference that the delegates might easily have found more time to devote to the ladies.

THE Carmelite Monastery at Niagara Falls, Ont., is trying an experiment in heating by electricity, which will be watched with interest. The whole building will not be so heated, but having arranged for a fixed amount of power, all of which is not required for other purposes, the surplus is to be employed for heating. Electricity is not an economical agent for heating so far, and is used on street cars on account of its convenience, and because the current cuts no figure in the railway's expense account. But it will be employed at the monastery under favourable conditions, and the result will be of service in arriving at the relative cost as compared with other methods.

IT seems unfortunate that the Association of Stationary Engineers should have been organized upon the basis of a fraternal order, with all the paraphernalia of a secret society not that we have *anything* to say against such societies, or lodge-room methods, but because the cumbersome machinery of a secret society is unnecessary where there is nothing to conceal. Further, the ceremonies of initiation, etc., cannot always be carried out in an impressive manner, in which case they have a bad effect upon those who take part in them, and they occupy time which might better be devoted to the legitimate purposes of the organization. The association has for its object the improvement of its members in their chosen calling, and this is not helped by secret society methods.

AN application is before the United States Senate for the right to build an electric railway from New York to Washington, on which a speed of one hundred miles an hour is to be maintained, which really means one hundred and twenty miles an hour including stoppages. The Brott system is to be employed, in which the cars run upon one wheel in the centre, and the track is elevated about two feet, except at road crossings, where it will be higher to allow a passage underneath. An absolutely straight line is required. The trolley system is employed with the conductor underneath. An experimental line of thirty miles is to be built between Washington and Chesapeake Bay. There seems to be no reason why the plans of the projectors should not be realized. The New York General Electric Co. is prepared to guarantee all the mechanism required, and to maintain a speed of one hundred and fifty miles.

AT the recent meeting of shareholders of the Grand Trunk Railway, presided over by the new president, Sir Charles Rivers Wilson, a statement was presented showing that the company at first leased, and afterwards purchased the Belt Line Railway encircling the city of Toronto, constructed some five or six years ago, and that after having invested nearly half a million dollars, had found that they were unable to operate the line at a profit and had decided for the present at least to allow it to stand idle. It seems to us that this line, if equipped as an electric trolley route, might profitably be handled by the Toronto Street Railway Company. The road runs through one of the most picturesque

routes in America, and might be made a very profitable pleasure road. It certainly cannot be made to pay as a steam road, or for ordinary passenger and freight business, but as a pleasure road, in summer at least, we believe it could be made a paying adjunct to the already profitable city system.

THE secondary wiring system supplied by a central station, is a very important feature of the whole, and should be so regarded by the manager. There is a practice allowed in some of the medium sized towns that cannot be too strongly condemned. It is allowing any wiring contractor who sets up in business, to take contracts for wiring houses, etc., without reference to his experience, or antecedents, and without exercising any kind of supervision over his work. It certainly does not require any great amount of training to fit a man to do the mere installing work. A handy man who can use saw, screwdriver and pliers, can, without any difficulty, become a good wireman in a very few weeks, if he works at first with an expert; but this is by no means all that should be expected of a contractor who is to design the entire lighting system of a large residence, store, church or theatre. Such an installation is a small lighting system, and should be laid out with as great attention to the location of centres of distribution and drops at various points as is absolutely necessary in the design of the primary system in the streets. It seems usual to allow a drop of two per cent. in interior wiring between the transformer and the lamps. It is evident that with a margin of two volts on a 100 volt lamp, it is quite possible to so wire that the first lamp will receive the full pressure without any drop, while another will not get enough, and so on, but that if a little attention is paid to laying out the system, all the lamps will get the same pressure within a small fraction of a volt. This is only possible by establishing centres, and running mains, feeders and branches. Another important matter is, that however carefully a primary system is laid out, it is impossible to have just the same pressure at all points, and therefore it may so happen that the above two per cent. allowance is either too high or too low, by one volt. At a point close to a main or branch centre of distribution the pressure will be greater than at another point some considerable distance away, and the interior allowance should be in proportion. Two cases that came quite recently under the notice of the writer will illustrate the above remarks. In one town where considerable extensions were being made to the plant, two distinct wiring contractors were working independently. Some discrepancy having been observed, investigation showed that one was allowing two per cent. drop, while the other was allowing "no drop at all" i. e., was putting in such large wire as to have practically none. The result must be plain to anyone. In the second case, two men undertook to wire all the secondary system, and general dissatisfaction ensued. They had no experience in laying out work, and the pressures at the lamps were most various; in one case three lamps in different rooms had pressures varying by five volts among themselves. Central station men may think it is none of their business, and that if customers choose to engage outsiders to do the work *they must take the consequences. This is quite* so, but at the same time the central station feels the result of the poor service at the consumers' lamps. All work undertaken by outside contractors should be approved of by the central station manager before being done, and no contractor should be permitted to do any who cannot furnish satisfactory evidence of being competent to design and lay out work properly.

A MATTER that is of considerable importance to electrical men, and that receives much less attention than it deserves, is the wattage of lamps. The manufacture of incandescent lamps has been closely studied for several years now, and the many various factors that influence in greater or less degree their excellence are well known. Lamps can be manufactured, indeed, to conform to almost any required conditions; and the conditions of operation in different central stations, or isolated plants, are so different from each other sometimes as to require different lamps to produce sensibly the same results. In a large area of supply, for instance, when distribution is by the direct current, and where plenty of copper can be placed for feeders and pressure regulators and so on, it is expedient to use high efficiency lamps, two and a half to three watts per candle power. The requirement of this kind of lamp is, that the extreme range of variation in pressure to which it shall be subjected shall be very small; and this of course can be arranged when the business of the station is so large as to permit of the use of heavy feeders, and the allowance of very small drops. But on the other hand, a small area, where distribution is by means of alternating currents, with individual transformers placed feeding into small installations of lamps, without the intervention of secondary mains, is very much better served by the use of lamps of a higher wattage—three and a half to four watts per candle. No matter how carefully the primary system is laid out, the transformer itself, owing to the unavoidable imperfections of its design and construction, will introduce a variation in the pressure on its secondaries that will react more or less unfavorably on the lamps. Now, as a lamp becomes more and more efficient, i. e., takes less watts per candle, it absolutely requires a more and more close pressure regulation; and conversely, a less efficient lamp will not be so periodically affected by a large range of variation. If a transformer be used that varies three volts per cent. between no load and full load (a by no means unusual amount), then a lamp of quite three and a half watts per candle should be used; for if a three watt or less be used the range of variation will introduce great depreciation and consequent shortness of life; whereas a lamp of larger wattage will stand more rough usage. With a transformer giving a drop of one per cent. (which is done by the best makes) a higher *efficiency lamp may be used, with a consequent gain* in transformer and machine capacity. A machine constructed for 50 kilowatts will give a capacity of twelve hundred and fifty 2½ watt lamps; of one thousand 3 watt lamps; and of eight hundred 4 watt lamps; but to use these 1250 high efficiency lamps it is necessary to have the entire primary system carefully laid out; to use none but the highest class transformers; and to put in secondary mains throughout. It might be incidentally pointed out that this gain in lamp capacity is a strong argument in favor of using none but the very highest class apparatus, and of exercising the greatest *care in calculating a wiring system. Reduced to arith*metic the gain is something as follows: Using 2½ watt lamps instead of 4 watt gains 420 lamps; these at $5 per annum bring in an income, additional, of $2,100. This

will mean a net gain of about $1,300 per annum; against which must be placed the additional cost of A1 transformers over second rate ones, perhaps 10c. per light, and the cost of remodelling the entire wiring system - probably an expenditure of less than $1,000 would suffice to make all the necessary changes and improvements, and this investment would bring a yearly interest of at least 100 per cent. Central station men would do well to overhaul their entire plant, and see whether great improvements might not be effected as above.

We wish to point out that the credit for the design and construction of the new electric locomotive now in successful operation on the B. & O. at Baltimore, was by a slip of the pen attributed to the Westinghouse Co. instead of to the General Electric Co. The error would of course be generally understood, the pioneer work of the General Electric Co. in the field of heavy electric locomotives having been closely followed by the electrical public generally. The arrangement recently announced between the Baldwin and Westinghouse Companies is we believe due to the desire of the latter company to follow their great rival into a field which has now been shown by the success of the Baltimore locomotives to possess immense and immediate possibilities.

ELECTRIC LIGHTING IN TORONTO.

Some important developments are about to take place in the electric lighting situation in Toronto. The Toronto Electric Light Company is about to increase its capital stock from $500,000 to $700,000. The object of this increase in capital is to enable the Company to improve its equipment, and to engage in incandescent as well as arc lighting.

The Company have received tenders for the construction of two vertical high pressure condensing engines, each to have a capacity of 1,800 horse power, and to be operated at a speed of 100 revolutions per minute. Each of these engines will have two large fly wheels from which power will be transmitted by means of 36-inch belts, to four generators, each having a capacity of 12,000 lights.

In order to test the claims made on behalf of the monocyclic and three phase systems, it is proposed to install one generator of each system, and thus put the question to a practical test.

There is at present a large section of the city which is not reached by the mains of the Toronto Incandescent Light Company, and it is the intention of the Toronto Company to first supply these districts. They believe that by means of the over-head alternating system, they can successfully compete with gas, even at the reduced rate of 90 cents per thousand feet, at which price it is likely to be supplied in the near future, as a result of the decision recently given in the Courts against the Consumers' Gas Company. Gas at 90 cents per thousand feet is about equal to incandescent light at half a cent per light per hour, and this is the price which the Toronto Company propose to charge.

The Company point to the fact that Ottawa, with a population of about 50,000, has installed one incandescent lamp for every unit of population, and there are probably in daily operation in that city not less than 20,000 lights. The capacity of the Toronto Incandescent Light Company's station is said to be about 20,000 lights, and it is believed that this limit has well nigh been reached at the present time. If electric light can be supplied to all parts of the city at a price, little, if any, in advance of gas, it should be possible to much more than double the number of lights at present in use, taking into account that the population of the city is about 200,000.

It is also the intention of the Toronto Electric Light Company to greatly improve their arc lighting station. They propose to substitute for the present building a new fire proof structure. The new building will be constructed entirely of brick and iron, and the window openings will be so placed as not to expose the structure to danger from fire from surrounding buildings. It is proposed to bring the wires into the new building through terra cotta conduits and an iron tower. The switchboard will be in the form of panels, having an iron frame, and the instruments mounted on slate. Mr. Wright, manager of the Company, points out that the building when constructed will be in every sense fire proof. To use his own words, "there will not be a piece of wood as large as a lead pencil used in the construction of the building, so that with non-inflammable contents, there will be nothing to burn." It is intended to substitute a number of dynamos of large capacity, —say 125 lights—for the machines at present in use, which have a capacity of only 35 to 40 lights. The new building will be erected outside the present structure, which will afterwards be pulled down. It is the purpose to proceed immediately with the carrying out of the above mentioned improvements.

REGULATION OF WATER DRIVEN ELECTRICAL PLANTS.

During the discussion which followed the reading of Mr. Dion's paper at the recent Convention of the Canadian Electrical Association at Ottawa, a number of delegates asked for information which would show the exact benefit to be derived in the matter of better regulation, from exciting generators by separately driven exciters. No figures were then at hand, but we have since received some information which will probably be of interest to many of our readers. The Ottawa Electric Railway Company, at whose power house separate exciters is carried out with such beneficial results, made the following experiment before definitely deciding to install a special turbine for exciting purposes.

Two 400 h. p. generators, driven from the same countershaft, running at the same speed and voltage, and being practically alike in every particular, were selected to make the test. Both were self exciting, but the field circuit of one of them was temporarily connected to a generator driven from another water wheel. On both gates water wheels were securely set so that the amount of water supply could not vary, and the field charges of the two generators were adjusted till the difference of potential at the brushes of each generator was 500 volts. A load of 200 amperes was thrown on the self excited generator and the voltage fell from 500 to 250 volts in about five seconds. The load was then removed and as soon as the speed of the machinery again reached the normal point, the load was thrown on the separately excited generator. The E. M. F. this time only came down to 450 volts. Several other experiments were carried out along the same lines as this one and all showed conclusively the wisdom of making the proposed change from self to separate exciting.

ELECTRIC PLANT AT THE NEW UNION STATION, TORONTO.

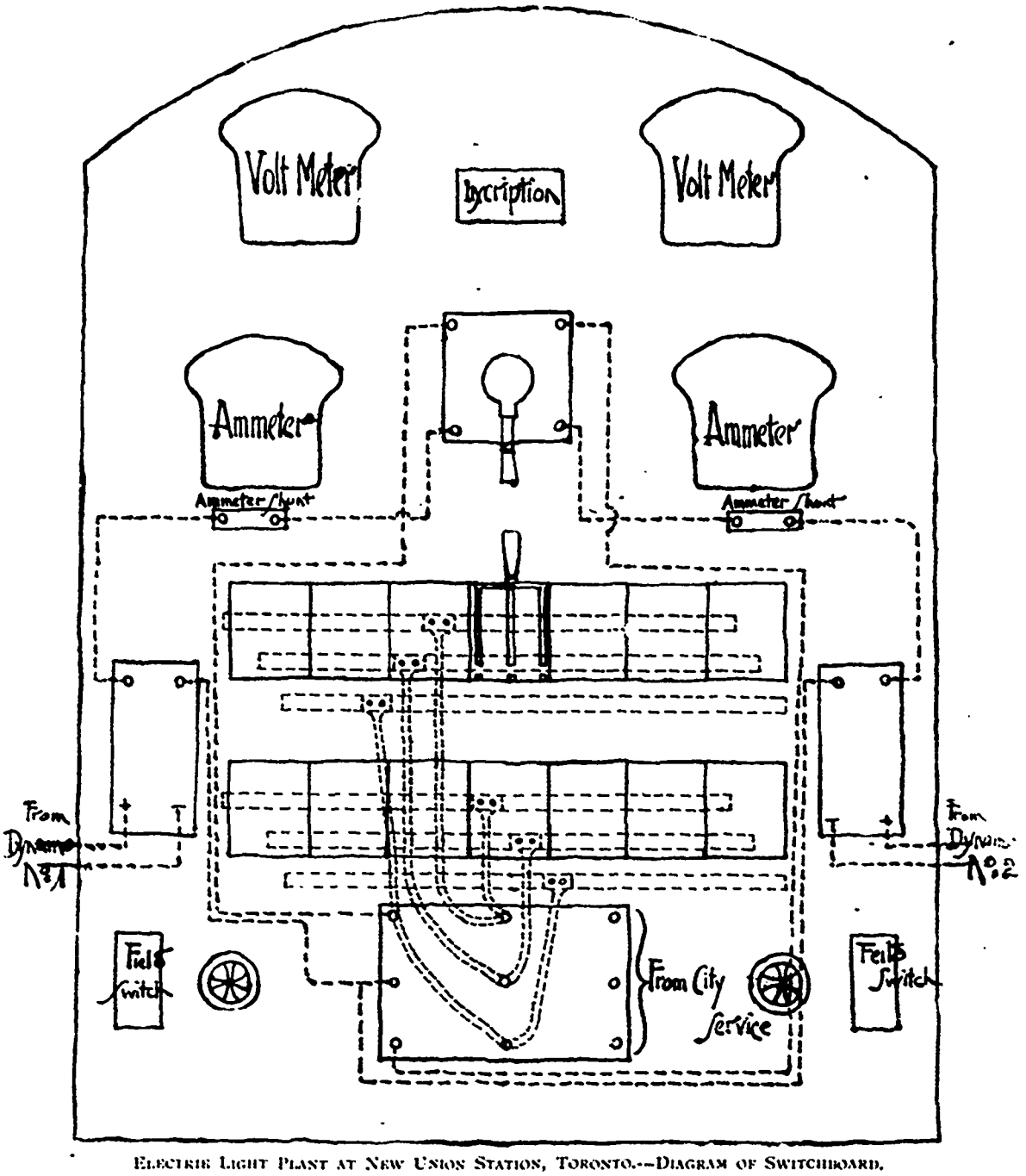
By the courtesy of Mr. Walter Fuller, electrician in charge, and Mr. Alexander Storer, chief engineer, a representative of the ELECTRICAL NEWS was recently given the opportunity of inspecting the steam and electric plant at the new Union Depot, Toronto. This plant is located in the basement of the new building recently erected immediately south of Front street.

The engine and dynamo rooms are extremely well lighted from windows opening on a lane on the west side of the building. The floors are of concrete, and everything about the place is clean and cheerful. There are three Babcock & Wilcox boilers—one of 186 horse power, and two of 93 horse power. These boilers are fitted with Murphy automatic stokers, and are the first furnaces installed in Canada in connection with which these stokers are employed.

The fuel is fed into a hopper from which it descends into a magazine, and from thence is automatically fed into the fire. Cold air is admitted just above the coal, by which means the smoke is consumed. The power required for the automatic feeding device is supplied by a 1 horse power automatic engine attached to the end of the furnace.

Screenings are exclusively employed for fuel. This fuel is brought into the lane on the west side of the building and dumped through a coal hole into the proper place in the boiler room. It is then loaded on a wheelbarrow, and by means of a compressed air hoist, the barrow, fuel and fireman are lifted to an iron platform at the top of the furnace, where the contents of the barrow are dumped into the hoppers already mentioned. By means of this compressed air hoist the ashes which come from the furnace are also lifted in buckets through another coal hole into the lane, where they are dumped into carts. This compressed air hoisting apparatus is in use at many points on the line of the Grand Trunk Railway, and was manufactured at the Company's works at Point St. Charles. The compressed air is pumped into a reservoir suspended from the ceiling.

Turning now to the steam and water apparatus, all



ELECTRIC LIGHT PLANT AT NEW UNION STATION, TORONTO.—DIAGRAM OF SWITCHBOARD.

returns come back from the south side station and the new station to a return tank from which they are pumped again to the boiler. The pumps for this purpose were also made at the Grand Trunk Company's works at Point St. Charles. The quantity of water is regulated by an automatic governor which shuts off the steam at given points. On account of the distance to which the steam has to be forced to the south side station, the return water is cold when it gets to the pump, in consequence of which it is forced through exhaust heaters before going into the boilers. The elevators in the building are hydraulic, and after the water has done its work at the elevators it is pumped back again into the pressure tank by a Northey pump, 14 × 8½ × 12 inches, fitted with a Fisher governor. In order to get the right quantity of air into the pressure tank, the air is taken from the air reservoir above referred to. In case of accident to the pump, the city pressure can be employed to run both passenger and baggage elevators.

There are two Robb-Armstrong high speed engines of 80 horse power each, fitted with automatic oilers. The exhaust steam from these engines is used to heat the buildings. The steam pipe to each engine is 4 inches in diameter, and the exhaust pipe 5 inches. Should the engine get a dose of water, automatic valves are immediately released, by means of which the water is got rid of. Mr. Storer, the engineer in charge, is an old employee of the Grand Trunk Company, and is well qualified for the position he now occupies.

Coming now to the electric plant, about 2,000 lights have been installed, forty of which are arc lights. For the operation of these lights two Canadian General Electric generators are employed. Both arc and incandescent lights will be run off the same generator. By means of a triple pole switch the current can be obtained from the Incandescent Light Company's system, in case of accident to the generators or when repairs have to be made. The building is wired for both the two and three wire systems. The switchboard consists of green slate panels, on which are mounted two Weston volt meters, two ammeters, sixteen 3 pole switches, two 2-wire dynamo switches, one break-down switch and two pilot lamps. A diagram of the switchboard is presented herewith, and will enable the reader to trace the connections.

The handsome general waiting room of the new station will contain a 250 light fixture, and the main corridor leading from Front street a 60 light fixture. The cut-outs are arranged in clusters on each floor, the lights on each floor being controlled at the switchboard.

The generating plant is not only designed to light the buildings, but to furnish current for the new electric signal system which the company now has under construction. The switches and semaphores will be lighted by incandescent lamps placed inside of discs carrying colored glasses, which revolve around the stationary lamp and display the different signals. The disc lights are operated by lead covered underground wires, and each light has an independent cut-out. As lead covered wire of sufficiently small diameter could not be procured for this work, the difficulty was got over by drawing No. 14 wire through a quarter-inch lead pipe, the space surrounding the wire being filled in with compound. The string by means of which the wire was drawn through was blown through the pipe by means of an air pump. This is believed to be the first instance Canada in which electric lights are used in switches and semaphores from an underground circuit. In case of accident the incandescent lamps within the revolving discs can be taken out and lanterns put in their place.

It can readily be seen that the installation of such a system as this necessarily involved much time and labor even under the most favorable circumstances, but in the present case progress was rendered extremely slow owing to the fact that the electrical work could not be pushed forward more speedily than construction in other departments. Owing to these circumstances, the whole of the present year has been occupied in bringing the work to its present state of completion. The Company purchased its own apparatus and materials, leaving in the hands of Mr. Fuller the carrying out of the work, which has been done in a highly creditable manner.

PERSONAL.

Mr. Francis John Bolger, C. E., of Lindsay, died Nov. 3rd, aged 61.

Mr. Nelson Smith, formerly of Ottawa, has been appointed engineer of the new Alexandria waterworks.

Mr. John Starr, who sold the first T.H. apparatus in France, is now a general dealer in supplies at Halifax.

Mr. T. Ahearn, the well-known electrician of Ottawa, and family, have gone for a trip around the world.

Mr. Joseph Wetzler, editor of the Electrical Engineer, was married at Delmonico's, New York, on Oct. 30th.

Mr. I. B. Britton, late manager and superintendent of the Trenton, Ont., Electric Co., has gone to Cleveland, Ohio.

Mr. J. J. Franklin, late superintendent of the Toronto Railway, but now of Jersey City, has returned to Toronto for the winter.

Mr. W. McKenzie, president of the Toronto Railway Co., accompanied Sir Wm. Van Horne, of the C. P. R., on his recent transcontinental trip.

Mr. Geo. M. Cole and Mr. A. E. Reynolds, both Brockville, Ont., boys, are manager and secretary respectively of the Plattsburg, N. Y., Light, Heat and Power Co.

Mr. Charles Aire has resigned the road superintendency of the Ottawa Electric Railway to take the management of the Ottawa Transfer Co. He is succeeded by Mr. R. F. Shaw.

Mr. W. McCulloch, of the Canadian General Electric Company, has gone to Prince Albert to install new plants for the Hudson Bay Company, and the Prince Albert Light and Power Company.

A double wedding took place at 92 Wilton Ave., Toronto, recently, when Misses Lillian and Nellie Broomhall were married to Mr. Arthur Arkhill, contractor, and Mr. Arthur M. Brodie, electrician.

Mr. J. H. Meikle, jr., of Morrisburg, Ont., who has been engaged in electrical engineering in Brooklyn, N. Y., has left for Bulwago, Matabeleland, South Africa, in the interest of a big American firm that has secured a large electric light contract in that place.

Mr. W. M. Peterkin, of the Toronto Incandescent Light Co., is dead, aged 74. He was born in Aberdeen, came to Toronto in 1850, was with the old Royal Canadian Bank and the wholesale dry goods firm of Shaw, Turnbull & Co. before entering the service of the Light Co.

The extensive shafting and expensive belting in the government printing office at Washington is giving way to an electrical equipment. Much of the work hitherto done by steam will be accomplished by electric motors. By the substitution of electric light for gas it is expected a saving of $1,200 a month will be effected.

The Canadian General Electric Scientific Club was recently formed at Peterboro, with the following officers: Hon. president, Mr. F. Nicholls; Hon. vice-president, Mr. S. Stephens; president, Mr. W. L. Cathwaith; vice-president, Mr. R. E. Layfield; Secretary, Mr. W. A. Brundrette; treasurer, Mr. J. F. Hedenberg; managing committee, Messrs. W. Robinson, C. Robertson, W. W. Stone, F. A. Shannon and H. L. Knowles. Its aims are the promotion of scientific researches in the interests of electricity, and the establishment of social intercourse and harmony between the electrical staff and foreman of the Canadian General Electric Co's works.

NINETY MILES AN HOUR.

NINETY miles an hour, and not by electricity, either, is what is promised by means of a steam locomotive being built at the Baldwin Locomotive Works in Philadelphia, to the order of Mr. W. J. Holmon, an old railway man and inventor, of Minneapolis, Minnesota. The mechanical principle on which it works is very simple and its application does for a locomotive what a bicycle accomplishes for a man increases his speed without extra exertion.

The device is what is known as a speeding truck. The engine is just like an ordinary locomotive, with driving wheels 5 feet in diameter, but it will be placed on friction geared trucks instead of resting on the rails, being thereby raised some 30 inches. The driving wheels rest upon and between two small wheels, which in turn rest upon and between three similar wheels, which rest on the rails. When the driving wheels turn they impart by friction a rotary motion, in the opposite direction, to the wheels on which they rest, and these in turn cause to revolve, in the same direction as the drivers, the wheels which rest on the rails. The speed is thus multiplied till it is just double that of the drivers, so that if they are running at a 45 miles an hour gait the engine will be propelled at a speed of 90 miles.

An experiment was recently made with an ordinary locomotive, mounted on Holmon trucks, over a branch of the Northern Pacific Railway, when a speed of 80 miles an hour was easily attained. It is expected, when the engine now being built is completed, the trip between New York and Philadelphia can be made in an hour. Very little has been said about the invention, and the latter run is intended to be its formal introduction.

The inventor claims another advantage besides speed. By the distribution of the weight of the locomotive on so many more wheels he says the wear and tear of the track will be greatly reduced.

The success or failure of this new engine will be watched with much interest, as upon it may depend to a considerable extent the substitution of electricity for steam on our railways.

A CANADIAN'S SUCCESS ABROAD.

PROMPTED by the pride which we always feel in the success achieved by Canadians, THE ELECTRICAL NEWS takes pleasure in reproducing from a recent number of the Electrical World, the following sketch of the successful career of one of our young countrymen: –

Mr. Arthur E. Childs, New England manager of the Electric Storage Battery Company, a conspicuous representative of the younger element which has admittedly contributed in large degree all along to the advancement and success of electrical industries, was born in Montreal, Canada, in 1865. After having obtained all possible advantages in the public schools he entered McGill University, confining his studies there particularly to mechanical engineering for four years and graduating in 1888 with the degree of Bachelor of Science. During his term at McGill University four months of each year were spent in the machinery department of the Grand Trunk Railway Company, thus securing for Mr. Childs a practical, mechanical knowledge. In September 1888, he went to London, England, entering the Central Institute of Technology, which is now affiliated with the Royal College of Science, graduating from there in 1891 with the degree of Electrical Engineer. Returning to Canada, Mr. Childs commenced his business career in charge of the experimental and testing departments of the Canadian Edison Company, at Peterboro', Ont., where he remained about one year. He left this company to connect himself with the Niagara Power Company, as assistant to Dr. Coleman Sellers, for which position he was recommended by Prof. W. C. Unwin. His position necessitated frequent visits to the works of the Westinghouse Electric Company, at Pittsburg, where he was brought into touch with Mr. Westinghouse and Vice-President Bannister, the result being an offer from these gentlemen to connect himself with the Westinghouse Company, which offer was accepted. From Jan. 1, 1893, until July 1, 1895, he was located at Philadelphia as engineer for the Westinghouse Company, after which period he took his present position with the Electric Storage Battery Company. Mr. Childs' business experience having covered only about four years, the fact that his connections have always been of a prominent character and came to him unsolicited, testifies abundantly to the excellence of his natural ability. Personally he is one of the most pleasant of men and is possessed of social characteristics which make and hold friends. In business he is quick in determination and prompt in action, and concentrates his fullest force and energy upon every undertaking. These characteristics have undoubtedly gained for him the enviable positions he has held and led to his present connection with the Electric Storage Battery Company, for which he is doing a most successful business in New England, and which corporation may be congratulated upon having such an able representative. Mr. Childs is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the Canadian Society of Civil Engineers, the Institution of Electrical Engineers, of London, and the London Physical Society, and is Honorable Councillor of McGill University.

TRADE NOTES.

The London Electric Co. are installing an additional 2,000 light alternator of the Canadian General Electric Co. make.

The Ottawa Porcelain and Carbon Co. have just turned out their first kiln of carbons, and the product is declared to be of very satisfactory quality.

W. S. Shaw, of Bracebridge, is installing a power distribution plant in the Shaw-Cassels tannery at that point. The Canadian General Electric Co. have the contract for the apparatus, which consists of a 75 horse power generator of the multipolar type with four motors of the slow speed, railway type.

SPARKS.

Electricity is now employed for killing the dogs which the dog catchers capture. The street lighting current is employed.

The following towns and villages are putting in electric lights: —Farnham, Que.; Chicoutimi, Que., and Frelighsburg, Que.

The Hawaiian government has granted a subsidy of $40,000 a year towards a telegraph cable to the United States. The latter is expected to grant a like sum.

New Westminster, B. C., proposes to sell its electric light and water works, both now owned by the city, to private parties. Neither enterprise pays its way.

It is said that a piece of steam hose, attached to the boiler, will do more work in cleaning greasy and dirty machinery in a few minutes than close application and ordinary methods in hours.

The Dominion Government has agreed to grant permission to lay a new telegraph cable, from Victoria, B. C., across San Juan de Fuca Strait, to connect with the United States lines. A private company will be formed to build it.

The Baldwin Locomotive Works at Philadelphia are building two kinds of electrical engines, one with light trucks for elevated roads and one with heavy trucks for suburban traffic. It is expected a speed of from 40 to 70 miles an hour will be attained.

Messrs. F. M. Bowden, chief engineer, Royal Victoria Hospital, and Owen Hughes, chief engineer, Royal Electric Company, have passed the first class examination at Montreal as steam engineers, enabling them to take charge of large plants in the city of Montreal.

The Citizens Light & Power Co., and the Standard Light & Power Co., owning franchises in the western suburbs of Montreal, and the right to light Montreal Harbor, have transferred their franchises to the Lachine Rapids Hydraulic & Power Co., a powerful and wealthy corporation.

A recent collision of a Spanish cruiser with a merchant steamer off Havana is attributed to the sudden extinction of the electric side lights. The lights failed from an extraordinary cause. A sailor became entangled in the electric lighting machinery, and those in charge of it stopped it to save the man's life. The result was the loss of some fifty lives and the cruiser herself.

SPARKS.

Huntsville, Ont., proposes to have electric light.

The London, Ont., electric railway has 22 miles of track.

A telephone line is being built from Renfrew to Eganville.

The Rossland, B. C., Electric Light and Power Co. has been incorporated.

The Power Rope and Belting Co., Ltd., of St. Catharines, is seeking incorporation.

The capital of the Toronto Electric Light Co. has been increased from $500,000 to $700,000.

The Belleville Traction Co., capital $100,000, to build an electric road in Belleville, has been incorporated.

The Halifax Illuminating Co. are installing a 300 kilowatt monocyclic plant for incandescent lighting and power.

The following places are talking of introducing electric light:—Tavistock, Ont.; Pakenham, Ont.; Hampton, N. B.; Aylmer, Que.

In Toronto there are 117 miles of underground electric light and telephone wires. The total length of overhead wires is 4,288 miles.

Electricity is to be carried across the St. Lawrence from Quebec by cable for the purpose of lighting the church of Notre Dame de Levis.

The Toronto Electric Light Co. have purchased a 75 kilowatt alternator of the monocyclic type from the Canadian General Electric Co.

Theo. Viau, contractor, of Hull, Que., is trying to sell his franchise for an electric railway between Hull and Aylmer to a New York syndicate.

Mr. Jennings, late city engineer of Toronto, has made an examination for an electric railway from the station to the town of Edmonton, N. W. T.

An order has been made by Judge McMahon, at Osgoode Hall, declaring the Brantford Electric and Power Co. insolvent and ordering its winding up.

The boot and shoe manufacturers in the United States have taken advantage of electricity as a motive power more than any other branch of trade.

The Niagara Falls, Ont., Electric Light Co., which was to take 500 additional horse power from the Electric Railway Co., has decided to put in a steam plant.

Mr. H. J. Beemer is said to be negotiating for the purchase of the plant of the Montmorency Power Co., with the view of incorporating it with the Quebec city system.

The Barrie & Allandale Electric Street Railway Company has been incorporated, with a capital of $5,000. A park on the shore of Kempenfeldt Bay is part of the scheme.

The township of East Flamboro has offered to submit a bonus by-law for $30,000, and the village of Waterdown for $6,000, to aid the International Radial Electric Railway Company.

Niagara Falls is to be illuminated by a search light placed on the Canadian shore by the Michigan Central Railway. This will enable visitors to view the Falls at night as well as by day.

There are now 850 electric railways in the United States with more than 9,000 miles of track, 2,300 cars and a capital of $400,000,000. In 1887 there were only 13 roads with about 100 cars.

The Royal Electric Co., of Montreal, has been reorganized with Mr. W. H. Brown as manager. Contracts have been secured for lighting Logan's Park, Brock street tunnel and the Lachine canal.

A charter is being applied for to build the North Nation Valley Colonization Railway from Montebello and Papineauville on the C. P. R. northerly to meet the St. Jerome branch of the same road.

A Montreal jury has given a verdict of $6,000 damages in favour of Mr. Grose, who sued the Holmes Co. for removing a galvanometer from the office of the Dominion Burglary Guarantee Company.

The Royal Electric Co., of Montreal, has now nearly 60,000 incandescent lights in use. The increase during a recent week was 965. Their report shows a profit of $106,209.14 on fifteen months work.

The C. P. R. telegraph operating room at Ottawa is to be equipped with the chloride accumulator storage battery instead of the gravity battery now used. Two hundred and thirty-five cells will do the work which now requires a thousand. It will be the first office so equipped.

D. Knechtel, of Hanover, is installing a 75 kilowatt alternating plant of the Canadian General Electric Co.'s monocyclic system.

Brockville has made a new contract for street lights. It will pay $105 per year for thirty arc lights, and $20 per year for one hundred gas or incandescent lights. The total cost of lighting will be $5,350.

According to the British Medical Journal, telegraphers are alarmingly subject to consumption. The general death rate from that disease among adult males, is 13.8 per cent., while among telegraphers it is 46.6 per cent.

The Kingston and Cataraqui Street Railway Co. have placed an order for additional cars and G. E. 800 equipments with the Canadian General Electric Co.

Velhagen has discovered that the electrical action of the eye is changed in disease of the optic nerve. Examination was made by placing one sponge on the nape of the neck, with the other over the eye, and using a galvanic current.

The Geo. F. Blake Engine Co. has sued the city of Toronto for $8,600 kept back because the new water works engines were not completed within the contract time. The company alleges that the city was principally to blame for the delay.

Mr. E. Franklin Clements, of the Standard Telephone Co., New York, is trying to obtain the consent of the Prince Edward Island government to construct a telephone system throughout the island, and also build an electric street railway in Charlottetown.

The suit between the Western Brake Co., of Pittsburg, and the Boyden Brake Co., of Baltimore, for alleged infringment of patents on quick acting air brakes, has been decided by the Court of Appeal at Richmond, Virginia, in favor of the Boyden Co. on all points.

The Ottawa Journal recently interviewed twelve presidents of city labor unions on the Sunday street car question. Eight were in favor of Sunday cars and four against. The question is not a live one in Ottawa, and many of the directors of the Street Railway Co. are opposed to Sunday cars.

Mr. Wm. Tanner, foreman of track laying, and Mr. J. M. Anderson, foreman of grading, on the London, Ont., street railway, have both been remembered by the employees under them. The former was presented with a rocking chair for himself and one for his wife, the latter with a writing desk.

Almonte is considering an estimate for a civic lighting plant by which business houses can obtain 16 candle incandescent lamps for one cent per night, and private houses for half a cent per night, while arc lamps for street lighting will cost only $35 per year. The plant would pay for itself in ten years out of the receipts from private consumers.

A Quebec paper prints the following extract from the records of the proceedings of the Sacred Congregation of Rites, of Rome, June 4, 1895: "*Question. May electric light be used in church?* Answer. For purposes of worshop, no; but for dispelling darkness and more brilliantly illuminating the church, yes; but care must be taken that the manner of illuminating shall not resemble a theatrical spectacle."

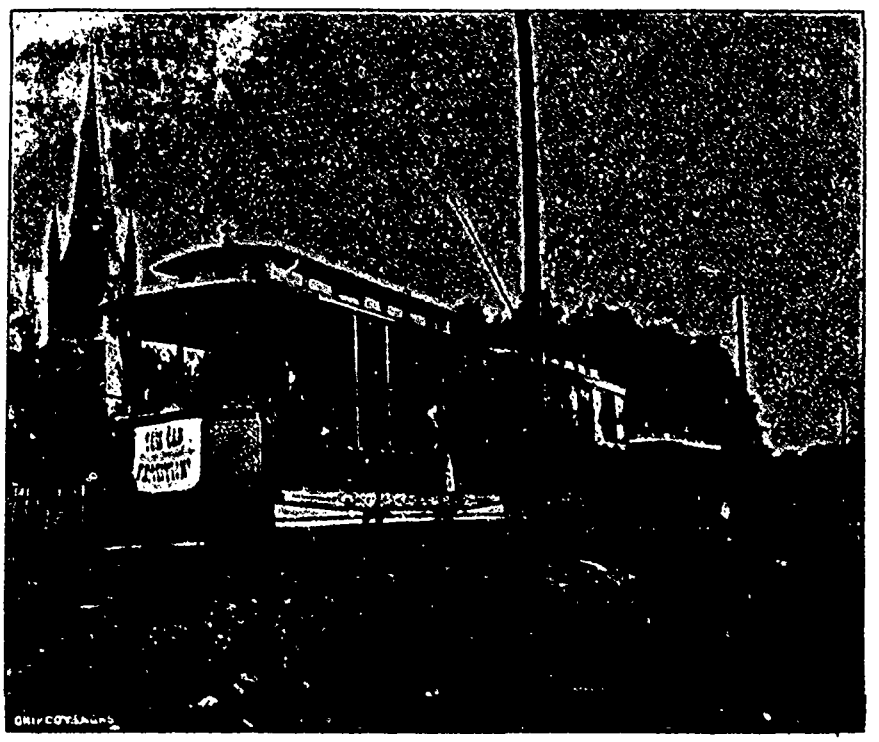
A new application of electricity to medicine is announced. A current of high frequency and high potential is caused to traverse a large helix inside which the patient is placed, the effect being to set up induction currents of a similar kind. These produce nutritive changes of great advantage in cases of impairment of nutrition. Benefit has also been derived in anaemia and debility, gout, rheumatism, neurasthenia, hysteria, diabetes, etc.

A sensation has been caused on the United States side of the Niagara river by an announcement that the Attorney General of the state of New York has decided that it is unlawful for the Niagara Falls Hydraulic Power and Manufacturing Co. to take water from the river above the falls. This gives the Niagara Falls Power Co. and Cataract Construction Co. a monopoly. The latter has decided to put in three more 5,000 h.p. turbines and generators.

The department of public works at Ottawa has written to the city council, asking the latter to assume the electric lights at the parliament buildings and the governor general's residence, on account of the cost of inspection, and offering to recoup to the city the cost of the lights. The government pays $100 per light for 24 lights and has been offered a reduction to $85, while the city pays the electric company only $65. The city objects to light the government property because the latter pays no taxes. The council now offers to assume the cost of inspection.

ELECTRIC RAILWAY DEPARTMENT.

SANDWICH, WINDSOR AND AMHERSTBURG ELECTRIC RAILWAY.



SANDWICH, WINDSOR AND AMHERSTBURG ELECTRIC RAILWAY.

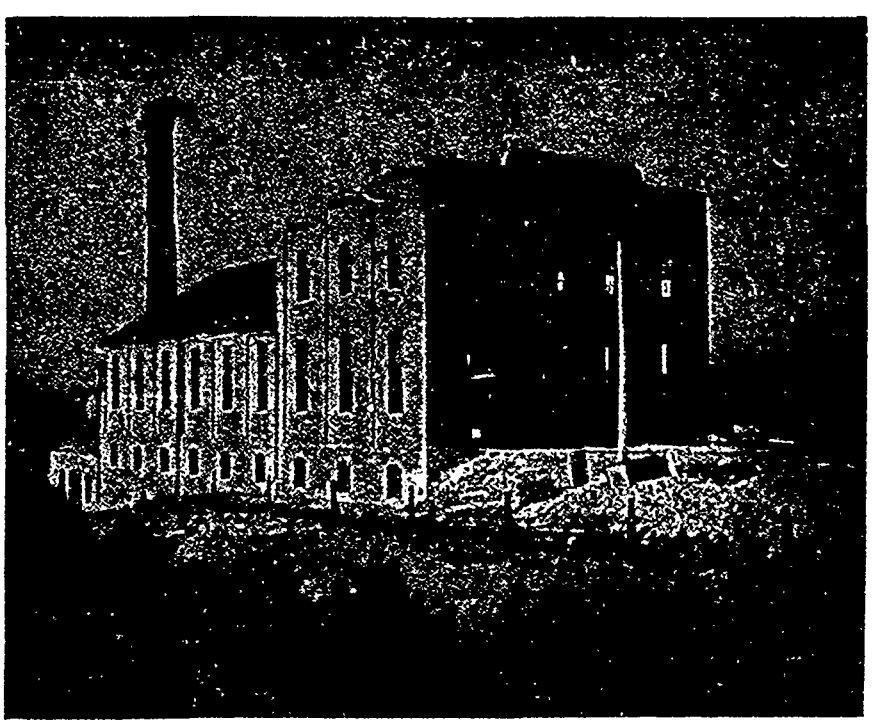
Some years ago we gave a description of the above street railway, which was then known as the "Windsor and Sandwich Electric Railway." The present company secured a charter to extend the road to Amherstburg, which will be done or commenced next year. The system has been extended to Walkerville.

The company is composed as follows: Directors: Dr. Coventry; Jno. Davis, Inspector of Distilleries; Wm. J. McKee, M.P.; Wm. J. Pulling, lumberman; Jas. Anderson, all of Windsor; Geo. M. Hendrie, Detroit; Wm. Hendrie and Robt. Thompson, of Hamilton. Officers: President, Dr. Coventry, Windsor; vice-president, Geo. M. Hendrie, Detroit; treasurer, Wm. J. Pulling, Windsor; secretary, Jas. Anderson, Windsor; accountant, Jno. M. Little, Windsor. Managing Committee: Rufus Caufield, superintendent; Earnest Schultz, electrician; Ervin Lloyd, chief engineer. Executive Committee: Dr. Coventry, Geo. McHendrie, Jno. Davis, Wm. J. McKee, Wm. J. Pulling.

The electric light department is managed by the secretary, Mr. Anderson.

The company operate ten miles of road between Windsor, Walkerville and Sandwich. They run a 15-minute service between these points. All the cars radiate from the corner of Sandwich street and Ouellette avenue. Three run to Sandwich, out London street, past the Sulphur Springs; three run from the M. C. R. depot to Walkerville, by way of Sandwich st., Ouellette ave., Wyandotte ave. and Second ave., connecting there with the L. E. & D. R. R. Two run from Gladstone ave., on Sandwich st., north to the driving park, 2¼ miles out Ouellette ave.

The company have 14 motor cars, 3 equipped with "Maguire" trucks and 11 with "Brill" trucks. The motors used on these cars are three 30 h. p. Westinghouse; eight 20 h. p. Westinghouse and three 30 h. p. Detroit. They have a total of 22 cars—10 box, 8 open, and 4 trailers. They will add a street sprinkler and 3 summer cars next summer. All the cars are heated by electricity. At present the company are vestibuling their box cars and the work done is as good as any carshop could turn out.



POWER HOUSE AND CAR STATION.

Most of the rails used are of the T rail pattern, and the line out Ouellette ave. on the pavement is the straightest and best laid in the country. The T rails are 56 lbs. Although only a one track system, the cars run close to schedule time, and there is no unnecessary delay. The conductors are always obliging, and it is a pleasure to use their line. The

business during the race meet is something enormous. The company claim that running their regular service they can carry away 2,000 passengers from the driving park to Sandwich—a distance of 2¼ miles—in 30 minutes. We show a number of cars in the accompanying cut on their way to the Exhibition grounds.

The power house, of which we show a cut, is a two storey and basement brick structure on London street. The building is 150 feet long by 50 feet wide. The ground floor is used as a car shop, in which all the cars are overhauled, painted, etc. The top storey is used by the superintendent and unmarried men for quarters.

An addition at the rear of 50 × 50 ft. comprises the boiler room. It is on a level with the basement, in which are the engines and machines.

We are sorry that we could not get a cut of the power room, as it contains the only pair of cross compound Robb-Armstrong engines in Canada.

In the boiler room are three 80 h.p. Monarch boilers and two Polson boilers. Natural gas, forced in pipes from Kingsville, is used for fuel, and the volume is regulated by steam. The fires were lit last May and have not been out since. In case of an accident, the one group of boilers could be cut off from the other. Natural gas as fuel needs but little or no attention, and is cheaper and cleaner than the use of coal. A recent drop in the price is inducing other plants to apply it.

In the power room, which is 75 × 50, are three engines running onto a line of shafting 45 feet long. A 200 h.p. Brown-Corliss, and a pair of Robb-Armstrong cross compound engines, 275 h.p. each, furnish the motive power. The Brown-Corliss is a good running engine, having been in service a number of years. Its fly wheel is 12′ dia., 28″ face, and weighs 12 tons. It is driven by a 24″ double belt onto a three-foot pulley on the line of shafting; a grip coupling connects with or separates the engine from the rest of the shafting. Two other grip couplings are on the line of shafting, one for each engine.

The company supplies the citizens with 3,000 incandescent lights, and power to six local institutions. Eight machines are run from the shafting, as follows: two railway generators, one of 150 h.p. Westinghouse, the other 200 h.p., same make; three alternators, two C. G. E., of 2,000 and 1,000 lights capacity respectively, each with an exciter, and an 800 light Westinghouse with exciter.

The switchboard is a large one, built of native wood, with full equipment of instruments. Full load can be thrown onto either of the Robb-Armstrong engines without any perceptible difference in the light or power. A heater is used for each engine, and water is delivered to the boilers at 210°.

Under the car shop an electrical repair shop is fitted out, in which duplicate armatures are always kept on hand, in case of accident. This department is in charge of Mr. Earnest Schultz, electrician. Mr. Ervin Lloyd has charge of the engines, and Mr. Rufus Caufield is superintendent. These mechanical men have had a life-long experience and the company's interests are safe in their hands.

The President, Dr. Coventry, makes his daily visit, and while he and our representative were there his medical knowledge was brought into use, as the chief engineer, Mr. Lloyd, was taken suddenly ill. The cause was too much study. Mr. Lloyd is taking a mechanical course in Detroit.

At the Sandwich end of the line the old horse barns are utilized for storing extra cars.

Windsor is said to have had the first electric road in Canada. It was the old Vandepoel system. One car was the extent of its service. It ran along the river front, and the conductor, Mr. Vallance, cigar dealer, tells many interesting things of it. One funny thing it would do was to stop all watches that came near it.

The company occupy offices on Ouellette ave., but are going to build a building of their own at a cost of about $20,000. The site is not settled yet. All the members are shrewd business men, and the company is in a flourishing condition. They propose opening a park for the use of their patrons near Sandwich next summer. When the Amherstburg end is opened up, this railway will be one of the best in Canada.

THE CONTINUOUS RAIL IN STREET RAILWAY PRACTICE.

Mr. Richard McCulloch, C. E., of the Citizens Railway Co., St. Louis, which has constructed and put in successful operation a piece of road constructed on the continuous rail principle, in a paper read before the Engineers' Club of that city, recently, sums up the subject in the following words: It is not to be supposed that the millennium in track construction has already been reached, but what has been demonstrated is this: First, that the use of a continuous rail for street railway practise is feasible; and second, that it is possible to make joints of sufficient strength to stand changes of temperature. Whether new difficulties will develop remains for the future to show, but let us hope that those of us who have placed our faith in rail-welding will not share the same fate as Jules Verne's armor maker, who planned, mixed, forged and tempered his best only to see the triumph of his skill shot to pieces by the latest gun of his hated rival.

SPARKS.

Since the adoption of electricity the receipts of the London, Ont., street railway have trebled.

The Montreal Electric Railway Co. have fourteen snow sweepers ready for this winter. They are from 70 to 100 horse power and can clear the lines of light snow in 40 minutes.

The railway branch of the Victoria, B. C., Electric Railway and Lighting Co. does not pay and there is a prospect that the bond holders will take over the road and operate it.

The Hamilton Street Railroad Co. asked to have the city by-law regulating it amended, but the council look upon the concessions as worth $6,800 a year and refuse to change the by-law.

The Montreal and St. Lambert Bridge Electric Railway Co. is seeking a charter to build a bridge across the St. Lawrence and operate electric roads from its terminus through the counties of Chambly and Lapairie.

A street railway track without ties is in operation in Detroit, Mich. The tracks are laid in a 6 inch bed of cement, and although a radical departure from all established methods it has been in use long enough to be pronounced a success.

Mr. Jas. Devlin, engineer at the Kingston Penitentiary, recently sued the city of Kingston for $100 damages for a broken leg, caused, as he said, by stepping into a hole. The trial was a long one, and it was proved that the injury was caused by stepping from an electric car. Eleven of the jury were for dismissing the action and the judge ordered a verdict for the city.

Mr. Paul Meyer recently recovered $296 damages in the superior Court, from the Montreal Street Railway Co., for running down his vehicle with one of their cars in Oct. 1893. The street was narrow at the place, the company occupied nearly half of it with their double track and it was obstructed with earth and stones. The car came behind Mr. Meyer and the motor man did not ring his bell or stop his car as he might have done.

SPARKS.

The Petrolea Advertiser has installed a Baird electric-gas engine of 2 h.p.

The Dunnville Electric Light Co. started up their new monocyclic plant recently.

The Ottawa Street R. R. Co. has declared a quarterly dividend of 2 per cent.

The Ottawa Street R.R. Co. has agreed to extend their lines to Hintonburg this fall.

English capital has been secured for building the Cornwall Electric Street Railway.

The Canadian General Electric Co. are installing an incandescent plant in Nelson, B. C.

The Ottawa Street Railway Co. has spent $125,000 this season on track construction.

A new switchboard has been placed in the Kingston office for the long distance telephone line.

Joliette, Que., is discussing the project of an electric railway to St. Lanoraie, on the St. Lawrence.

The citizens of Winchester are reviving the agitation for an electric railway between Morrisburg, Winchester and Ottawa.

Cote St. Paul, Que., town council is asking the Park & Island Railway Co. to give them street railway connection with Montreal.

Messrs. Moore & Sons, of Meaford, have installed a new 500 light alternator. The Canadian General Electric Co. have the contract.

The Halifax Electric Tramway Co. have given the Eastern Trust Co. a first mortgage in trust to secure an issue of debentures to the amount of $600,000.

An electric railway is being discussed to connect Alexandria Bay with the the Rome, Ogdensburg and Watertown R. R. at Redwood. The distance is about seven miles.

Ahearn & Soper, of Ottawa, have the contract for the electric light works at Alexandria. A by-law to raise $6,000, spread over 30 years, will be submitted to the ratepayers.

A telegraph line from Boone Bay, Newfoundland, to the Straits of Belle Isle, a distance of over 200 miles, is to be built. This will enable ships to be reported when they pass the Straits.

Mr. E. A. C. Pew, projector of the scheme to build an aqueduct from Lake Erie to Hamilton, says his company is ready to go on with it as soon as the city grants the franchise.

Electricity is entering into almost every department of daily life as a labor-saving element. One of its latest uses is for cancelling stamps on letters, which is employed in the New York post-office. One man is able to do the work of four or five. By this ingenious contrivance the operator has only to arrange the letters, turn a switch, and cancel at any speed he likes.

The Alliston Milling Co. have increased their plant by a 500 light Canadian General alternator.

The Niagara Falls and River Railway finds it necessary to make four trips a day to Queenston. This service usually ceases after the steamers stop running.

The proposal to build an electric railway from Port Perry to Kincardine is meeting with much support. Mr. A. E. C. Pew is the promoter, and Mr. Brunell, C. E., is making surveys.

A Toronto syndicate is projecting an electric road at Chatham, Ont. It is urged in some quarters that the scheme should include connection with all the chief points in the county of Kent.

The Toronto, Hamilton & Niagara Falls Electric Railway is a new enterprise seeking incorporation. As the company desires to run Sunday cars a Dominion charter will be applied for.

The Hamilton, Brantford & Pacific Junction Railway Co. is applying for incorporation, with power to build a line from Copetown, on the T. H. & B. Railway, to Schaw Station, on the C.P.R.

The net earnings of the Montreal Street Railway Co. for the year ended 30th Sept., were about 10½ per cent. on the paid up capital of $3,444,000. The road is in a highly satisfactory financial position.

It is settled that work on the power plant for the Canadian Niagara Co. will begin within four months and be pushed to completion. Power will be ready early in 1897. The plant will be larger than that on the United States side.

An additional issue of stock, amounting to $400,000, has been made by the Incandescent Light Co., of Toronto. Nearly all of this new stock was subscribed for at par, by the directors of the company. The object in issuing the stock is said to have been to prevent the control of the Company from passing into the hands of the directors of the Toronto Electric Light Co., who are said to have quietly purchased a majority of the shares. There are now heard rumors of a probable amalgamation of the two companies.

The Supreme Court of the United States has just given two decisions of importance affecting electrical patents. In the case of the United States vs. The Bell Telephone Co., to cancel the Berliner patent, it is declared to have jurisdiction. This will bring the case before the court for final decision. In the case of the Edison incandescent light patent against the claim of the Consolidated Electric Light Company using the Sawyer-Mann system, of which it was claimed that the Edison system was an infringement, the Court held that the claims made for the Sawyer-Mann are too broad. The result will be to throw open both systems to the public. The Sawyer-Mann patent is invalid, and the Edison patent expired a year ago, under the operation of a former decision.

Burt & Rousseau, electricians, Montreal, have dissolved.

An electric road between Stirling, Ont., and the C. P. R. at C. O. Junction is projected.

The Hamilton Radial Railway Co. gives notice that it will apply for power to extend the Guelph branch to Lake Huron.

The Smith's Falls Electric Light Co. have purchased a 2,000 light alternator from the Canadian General Electric Co.

The Halifax Street Railway is getting 2,000 tons of rails for $14,000 less than the present price. Rails have risen $7 per ton since they were ordered.

One o the features of Mr. Pew's Port Perry and Kincardine electric railway scheme is the distribution of coal at a cheap rate from Whitby, where it can be brought by vessel from Oswego during the winter.

MOONLIGHT SCHEDULE FOR DECEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1.....	A.M. 4.10	A. M. 6.20	2.10
2.....	No light.	No light.	....
3.	No light.	No light.	....
4.....	P. M. 5.00	P. M. 8.00	3.00
5.....	" 5.00	" 9.00	4.00
6.....	" 5.00	" 10.10	5.10
7.....	" 5.00	" 11.30	6.30
8	" 5.00	A. M. 12.40	7.40
9.....	" 5.00	" 1.00	8.00
10.....	" 5.00	" 1.50	8.50
11.....	" 5.00	" 3.00	10.00
12.....	" 5.00	" 4.20	11.20
13.....	" 5.00	" 5.30	12.30
14.....	" 5.00	" 6.30	13.30
15.....	" 5.00	" 6.30	13.30
16.....	" 5.00	" 6.30	13.30
17.....	" 5.00	" 6.30	13.30
18.....	" 5.00	" 6.30	13.30
19.....	" 5.00	" 6.30	13.30
20	" 8.00	" 6.30	10.30
21.....	" 9.10	" 6.30	9.20
22.....	" 10.10	" 6.30	8.20
23.....	" 11.00	" 6.30	7.30
24.....	" 11.00	" 6.30	7.30
25.....	.....	" 6.30	6.20
26.	A.M. 12.10	.....	
27.....	" 1.10	A. M. 6.30	5.20
28.....	" 2.10	" 6.30	4.20
29.....	" 3.20	" 6.30	3.10
30.....	" 4.20	" 6.30	2.10
31.....	No light.	No light.	....
		Total,	224.40
		Grand Total,	2203.30

The Cliff Paper Co., of Niagara Falls, have decided to use electricity as a motive power. This will do away with three steam engines of over 200 horse power, and will enable them to make paper cheaper than formerly.

INSOLVENT NOTICE

In the matter of La Cie Electrique St. Jean Baptiste, of the City of Montreal, Canada, P. Q., in Liquidation.

THE undersigned will sell by Public Auction, in three lots, at the office of Chas. Desmarteau, Liquidator, No. 1598 Notre Dame St., Montreal, Canada, P. Q., on

THURSDAY, THE 19TH OF DECEMBER, 1895, AT 11 O'CLOCK IN THE FORENOON,

all the immovable properties and moveable assets of the said company, consisting of

(1) All those tracts and parcels of land situated in St Jean Baptiste Ward, in the City of Montreal, Province of Quebec, Dominion of Canada, described as follows:

A. The northeasterly parts of lots numbers 32, (thirty-two), 33 (thirty-three) and 34 (thirty-four), according to the official subdivision of lot number 10 (ten) of the official cadastre, of the village of St. Jean Baptiste, comprising an area of 4970 (four thousand nine hundred and seventy) feet, more or less, and bounded towards the north-east by Montana street, towards the south-east by Rachel street, towards the north-west by lot number thirty-five of said official sub-division of said lot number ten, and towards the south-west by the remaining parts of said lots numbers thirty-two, thirty-three and thirty-four, of said official sub-division of said lot number ten, with buildings and dependencies thereon erected.

B.—Lots numbers 35 (thirty-five), 36 (thirty-six), 37 (thirty-seven), 38 (thirty-eight), 39 (thirty-nine), 40 (forty), 41 (forty-one), and 42 (forty-two), of said official sub-division of said lot number 10 (ten), comprising an area of 17296 (seventeen thousand two hundred and ninety-six) feet, more or less, bounded towards the north-east by Montana street, towards the south-west by lot number sixty-one (a) of said sub-division of lot number ten, towards the north-west by lot number forty-three, and towards the south-east by lot number thirty-four of said sub-division of said lot number ten together with the right of passage in common with adjoining proprietors in the lane at rear of said lots.

C. All engines, boilers, dynamos, tank (45,000 gallons), machinery, belting, shafts and general plant used for manufacturing and generating electricity, as well as the wires and posts, transmitters, meters, lamps, etc., used for distributing and furnishing electric light to the citizens of Montreal and suburbs, the material and stock used for repairing the lines of the company, the whole amounting as per inventory to one hundred and forty-four thousand, three hundred and seventy-one dollars ($144,371.00.)

D.—The franchise rights and privileges acquired by the said company to plant poles in the streets of the city of Montreal

(2) The office furniture and fixtures, etc., amounting to $196.00.

(3) The book-debts, amounting as per list to $3456.00.

The purchaser of the immovable and dependencies described in paragraph (1) shall have to make a cash deposit of five thousand dollars currency ($5,000) at the time of adjudication.

The purchasers of moveable assets described in paragraphs (2) and (3) shall have to make a cash deposit of ten per cent at the time of adjudication

For further information apply to

CHAS. DESMARTEAU, Liquidator,
1598 Notre Dame St.,
Montreal,
Canada, P.Q.

MARCOTTE FRERE, Auctioneers.