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THE GUELPH ELECTRIC LIGHT COMPANY.

THE Guelph Electric Light Company has been doing business for a little more than five years, and so rapid has been the development of its business that three times during that period increased accommodation has had to be provided for its requirements. The last move in this direction was made early last spring when the company determined upon erecting a new building, which would meet its present and future necessities. This new building took the form of an addition to the buildings heretofore occupied by the company. The old buildings originally did duty as a flouring mill, being known as "Allan's Mills." They are situated close beside a branch of the Speed river, and in proximity to the two railway stations.

Considerable difficulty was experienced in obtaining a good foundation for the new building as the site, originally the river bed, had become filled up with decayed vegetable and other material of an elastic nature. The foundation, which is of stone built in cement, is about 4½ feet in thickness, and is carried to a considerable distance below the surface of the ground. There are two stone piers supporting the superstructure, and a number of others supporting the engines and shafting.

The whole building is of stone, the walls varying in thickness from 27 inches at the basement, to 22 inches above the dynamo room. The buildings are irregular in shape, the size of the new main portion being 45x63 feet, and of the old portion, 42x63 feet. The height of the ceilings is 7 feet clear in the condensing room, and 10 feet 6 inches in the other stories.

On the second floor, used as engine and oil rooms, there are oak posts resting on stone piers, supporting the upper floors; The dynamo room floor is constructed of 1¾ inch pine, supported by 14 feet 6 inch x 14 inch joists, which in turn are supported throughout their entire length by trussed girders. Where timbers come adjacent to one another or to the piers, sufficient space is provided to prevent vibration by contact, a point which was insisted on by the engineer.

The walls are built in cement and plastered on the inside; the ceiling is lathed and plastered on the roof boarding between the rafters, making the roof, in the opinion of the underwriters, fire proof. The roof of the newly erected part of the building is shingled, the shingles having been dipped in mineral paint, and afterwards painted over their entire surface. A wire tower, 14 feet square, occupies the north corner of the building.

The extension of 42x63 feet above referred to, used for boiler house, coal room, store room, repair shop and wheel house, is only one story high, and is roofed with iron.

The machinery has now been in operation about a month, and it is considered that during that time the building has been subjected to as great a strain as it is likely to be called upon to endure at any time in the future, owing to the fact that there has been more vibration than there will be after the machinery, shafting, etc., has been got into perfect working order.

NEW CENTRAL STATION, GUELPH ELECTRIC LIGHT COMPANY.

Some particulars concerning the nature of the plant and the manner in which it is arranged will no doubt be of interest. The motive power consists of both steam and water. The water is brought a distance of about fifty yards from the river Speed by means of a stone raceway, which passes right through one end of the building and enters the wheel house at the south corner. The head of water is 14 feet. There was originally in this wheel house, an old penstock, 12x5 feet; this has been replaced by a new one 12x14 feet, two-thirds of the space required for which had to be blasted out of solid rock, the space around the water wheels had also to be deepened in the same manner, to allow of the free exit of the water.

There are two turbine water wheels, each 33 inches in diameter, of the Little Giant pattern; one of these is a new wheel which has taken the place of a 17 inch wheel.

The volume of water varies considerably at different times in the year, and the amount of available power varies from 120 to 30 horse power. While the writer was inspecting the wheel house, the drive was started up, and an opportunity afforded of noticing how smoothly and noiselessly the wheels operate. When water is abundant, the smaller of the two engines with which the station is furnished, is used as an auxiliary to the water power, and as governor of the speed of the water wheels.

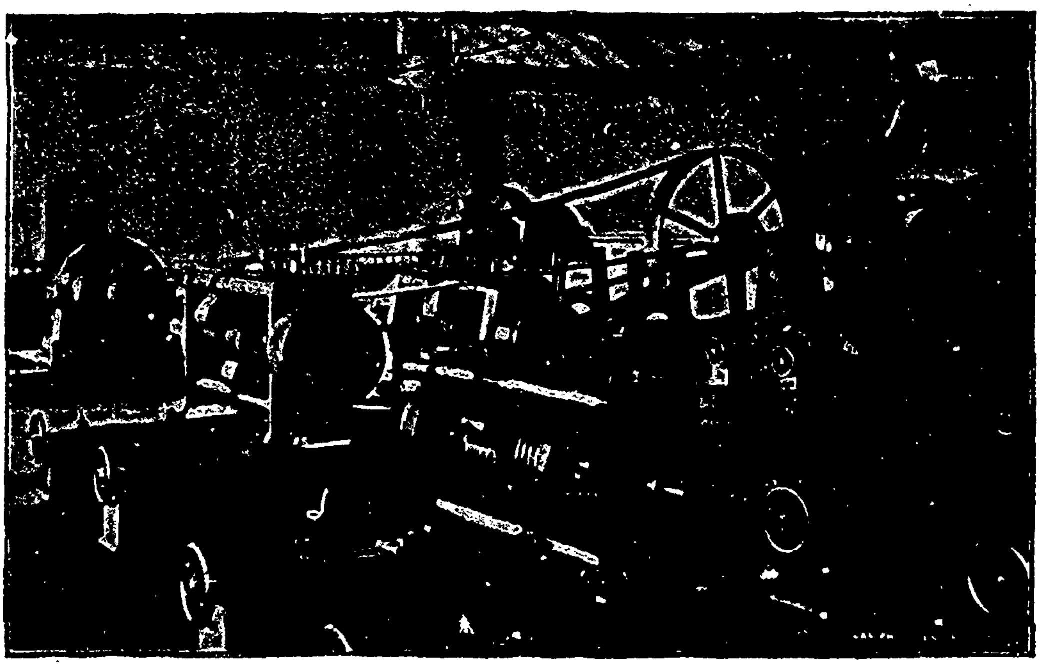
The boiler room contains two boilers, each of 75 horse power capacity. These boilers are encased in brick work.

The basement of the newly constructed building is occupied by the condensing apparatus, and is divided from the race by a 4 feet wall. The supply of water for condensing purposes is drawn from the race into a brick tank, and from this tank the condensers draw their supply, there is also a brick tank for receiving the condensation and water for the condensers, and from this the water supply for the boilers is pumped. There are two condensers and two pumps, the pump connections being so arranged as to supply one or both boilers. The floor of the basement is of pressed brick laid on edge.

An unusual appliance in electric light stations is here to be seen in the shape of a gas meter. The building is piped throughout for gas, which is used by the employees when the electric plant is shut down on moon light nights.

The engine room contains a Wheelock cross compound engine of 150 horse power capacity. This engine is mounted on a solid stone foundation extending down 9 feet below the basement floor. The driving wheel is 13 feet diameter, and 22 inch face; there is also a single cylinder condensing engine of 100 horse power, with a fly wheel 11 ft. 6 in. diameter and 20 inch face, the foundation for which corresponds to that of the larger engine. This engine was the one formerly used, and was moved from the old station. There is a counter-shaft driven off main shaft for operating the pumps and condensers. Adjoining the engine room, and separated from it by a 36 inch wall, is the oil room.

The dynamo room contains four arc and one incandescent dynamos, viz., 75 light, 35 light and 25 light Ball machines, a 50 light Reliance machine and a 500 light Royal alternating incandescent machine. The 50 light Reliance and 65 light Ball dynamos are used to supply current to the street circuits, and the smaller machines to furnish current for commercial business. These dynamos are belted to a line of shafting extending from end to end of the building; each dynamo is driven from a clutch pulley, and can therefore be operated independently or in conjunction with all the others.



VIEW OF DYNAMO ROOM, GUELPH ELECTRIC LIGHT COMPANY.

The switch board has been erected in the north corner, beneath the wire tower, and is fitted with the usual current indicators, etc. The engine and dynamo rooms are connected by call bells and speaking tubes.

The millwright work and power plant were supplied by Messrs. Goldie & McCullough, of Galt, and the belting by the J. C. McLaren Belting Co., of Montreal.

The architect who designed and superintended the construction of the building, is Mr. John Day, of Guelph.

As most of our readers are probably aware, the electric light and gas interests of the city are under one control. The president of both companies is Mr. D. Guthrie, Q.C., M.P.P., and the vice-president, Mr. Richard Mitchell. Both of these gentlemen have held similar relations to the gas company from the time of its inception, twenty-two years ago. The management of both companies is in the hands of Mr. John Yule, who has filled the position of manager of the gas company most satisfactorily during the last 21 years. Mr C J Jordan, the electrician in charge of the plant, has also been with the Electric Light Co. from its inception.

The company is a most enterprising one, and is now in possession of one of the most substantial and best arranged central stations to be found in the Dominion. It is their intention, we understand, shortly to install a power generator to furnish electric power for manufacturing purposes; the opening for business in this direction appears to be very promising.

An external view of the station together with a view of the dynamo room, are presented herewith.

IN RECOGNITION OF DEPARTED WORTH.

HAMILTON, Oct. 7th, 1892.

Editor ELECTRICAL NEWS.

SIR,—Hamilton Association No. 2, C. A. S. E., at its regular meeting held October 7th, adopted the following resolutions:—

"Whereas it has pleased the Almighty in his great wisdom to remove from us our late Brother, Douglas S. McKenzie, and

"Whereas this Association wish to recognize his many stirling qualities, therefore it is

"*Resolved*—That a fitting tribute be paid to the memory of the departed, setting forth that in lamenting his removal from amongst us, we mourn for one who was worthy of our most sincere esteem;

"*Resolved*—That we offer our heartfelt condolence to the bereaved ones in this their time of deep affliction, and most earnestly beseech them to seek consolation in their bereavement from our Heavenly Father, who in His great wisdom has seen fit to remove from them a beloved father and husband, always remembering that He doeth all things well;

"*Resolved*—That Hamilton Association No 2, C. A. S. E., extend their heartfelt sympathy to the family of the deceased;

"*Resolved*—That the Charter be draped for the period of 30 days as a tribute to the memory of the departed Brother, and that these resolutions be placed on the records of this Association, and a copy be sent to the family of the deceased Brother, also to the mechanical press for publication.

WM. MORRIS,
E. C. JOHNSON,
R. MACKIE, } Committee.

CANADIAN ELECTRICAL ASSOCIATION.

The executive, realizing the advantage of taking time by the forelock, have set about making arrangements for the January meeting.

The Secretary is in correspondence with certain members of the Association in the various departments of the electrical field, regarding the preparation of papers for the approaching meeting, and the consent of some has already been given. It is hoped that no one who has been asked to assist in this way to make the meeting a success, will decline to make the attempt, except under circumstances which would make compliance impossible.

A full meeting of the executive will be held a few days hence for the consideration of this and others matters.

The new power house of the Toronto Street Railway Co. and the Toronto Electric Light Company's new station, will, it is expected have arrived at completion by the first of the new year; these with the new Bell Telephone Exchange, and the headquarters of the local electrical manufacturers, will well repay a visit of inspection.

The Executive will welcome suggestions from any member of the Association which will be likely to promote the success of the coming meeting or the general interests of the Association

SUGGESTIONS TO ENGINEERS ON TENDING DYNAMOS—ELECTRICAL TERMS EXPLAINED.

Place the oil-catchers under the drip of the dynamo bearings, and never allow them to overflow on the floor.

Keep the floor of the dynamo room swept clean, so that no nails or other small pieces of metal can be drawn into the armature.

Never use or leave iron or steel tools near the machine, while at work, as these are also likely to be drawn into the armature if left too near it.

Oil cans made of copper or zinc are best for use about electrical apparatus.

Never allow oil to accumulate on the armature or shafts of the dynamo.

When the wires coming out of the shaft to the commutator become bare from cleaning, they should be recovered with kerite or okonite tape, or gum cloth, and shellaced, and allowed to dry for about eight or ten hours before being used.

If the shellac on armature bobbins or field magnets becomes worn off, these parts should be reshellaced.

A good bellows will be of service in getting dirt out of the crevices of the armature, and around the commutator and rockers.

If the rocker springs are fastened to a wood base, see that the screws which hold them are kept tight as the wood dries.

See that all thumb screws in the binding posts are kept screwed down tight on the wires. Special care should be exercised in regard to this in the case of incandescence machines.

In placing brushes, take pains to clamp them firmly in position, allowing them to rest squarely and evenly on the commutator. Be very careful not to screw down one side of the clamp tighter than the other, but clamp them evenly, so that both edges of the brushes will be held in place.

The clamps holding the brushes must be perfectly clean, so as to make good contact.

Brushes must bear on the commutator with a reasonable pressure, not too hard, nor so lightly as to allow them to flap or chatter. Occasionally, by accident or otherwise, the brushes will get bent, or sprung, and bear too lightly on the commutator. This condition of affairs is always attended with many sparks, and a very rapid cutting, or wearing of commutator segments. In fact, segments may be worn out in a few days, in this way.

If brushes are perfectly straight when put into the clamps, sufficient pressure will usually be obtained.

In an arc light, or high tension machine, if the brushes are rocked too far forward in the direction of rotation of the commutator, the sparking will quite disappear, but the lights will go out occasionally, each extinction being attended by a few very long sparks on the commutator. This trouble may be corrected by rocking the brushes backward a short distance. If brushes are moved too far back, there will be sparking, and a consequent diminution of light in the lamps, and occasionally extinctions of the lamps, similar to those which occur when the brushes are too far forward.

The proper point for the brushes is as far forward as possible, so as to make the sparks small, and yet back of the point where flashing will occur. In low tension, or incandescence machines, the brushes should be adjusted to show no spark, or only a very minute one, otherwise the wear on the commutator and brushes will be very heavy.

Too much oil on the commutator will cause sparks similar to those which appear when the brushes are not properly adjusted.

When brushes are worn neatly through, clip them off squarely at the worn ends, and move them up to the same position as before.

Cleanliness is absolutely necessary to the successful operation of an electric lighting plant. Too often the salesmen of manufacturing concerns give the impression that an electrical plant will almost take care of itself, and that it does not matter where you put it, whether in some out-of-the-way corner, on a shelf, or anywhere, so that it is not in the way. It is not reasonable to expect this of a dynamo machine, any more than of any other fine piece of machinery. Treat your electrical apparatus fairly; give it a location that shall be as clean as possible; grant it some attention, and you will be better satisfied. Poor and dirty oil will cause hot bearings, rapid wear, etc., and is, of course, much more expensive in the long run.

The commutator is a very important part of a dynamo, and should be given special care. It is well to wipe it off frequently with an oiled cloth, and whenever the machine is shut down, carefully brush off any particles of dust or copper which may have collected about the connecting wires, or other parts of the commutator. Should your brushes be of the style composed of a number of wires, soldered or bound together at one end, you will find that they have a great tendency to collect dust, copper filings and oil, which must be cleaned out. If they are attended to immediately after shutting down the dynamo, boiling water will generally clean them nicely. If, however, the oil and dirt are allowed to become dry and hard, it may, perhaps, be necessary to soak the brushes in kerosene oil for several hours. Care should be used in handling these wire brushes to avoid bending, as when bent, some parts of the brush do not do their work, and others are obliged to do much more than their share.

There are some places about a dynamo where oil will do more harm than good, as, for instance, the connections of the fields, and in and around the armature. It will sometimes work its way into the latter place, if care is not used to prevent same. In time oil is apt to rot the insulation, and the constant collecting on this sticky surface of dust and metal particles, tempt the current to break through the rotten insulation, resulting in a burned-out magnet, armature bobbin, or perhaps the entire armature.

Contacts of all kinds should be examined occasionally to see that they are bright and clean, as poor contacts make high resistance, and hence call for more power. They are also liable to heat up sometimes to a dangerous degree, this heating sometimes being so great as to cause a fire.

It is hardly necessary, we presume, to mention the fact that to obtain a clear and steady light from arc lamps, the carbon rods, as well as all other working parts of the lamps, must be kept perfectly clean, and in condition to work freely and promptly. The contact points in the cut-out mechanism should always be bright, so that in case they are called into action, a good firm contact will be made. A clean globe may, perhaps, not be absolutely necessary to the proper working of a lamp, but it certainly looks much better and offers no obstruction to the light.

No sooner has a dynamo been installed in a factory, or, we may say that as soon as its installation is completed and negotiations opened, we begin to hear about amperes, volts, ohms, megohms, etc., etc. It may, therefore, be of interest and profit to consider, briefly and simply, the meaning of these terms, as, when they are clearly understood, other matters are grasped more readily.

E. J. Houston, in his "Dictionary of Electrical Words, Terms and Phrases," states: "The ampere is the practical unit of electric current. Such a current (or rate of flow or transmission of electricity) as would pass with an electro-motive force of one volt, through a circuit whose resistance is equal to one ohm. That is to say, a current of the definite strength that would flow through a circuit of a certain resistance and with a certain electro-motive force. Since the ohm is the practical unit of resistance, and the volt the practical unit of electro-motive force, the ampere, or the practical unit of current, is the current that would flow against unit resistance under unit pressure or electro-motive force."

The ohm, as mentioned above, is the unit of resistance, and the volt the unit of force or pressure. A very simple and easy way to fix in one's mind these terms and their meanings, is to take the common illustration of the flow of water through a pipe. We will assume, for convenience, that we have a pipe one inch in diameter, and, say, five feet long, offering to whatever liquid is to be put through it, a friction of resistance of one ounce. We We now wish to put through this pipe one gallon of water, and therefore must have a certain amount of pressure to accomplish this result. Let us say that it requires a pressure of one pound to push the one gallon of water through the pipe mentioned, the friction resistance of the pipe being one ounce. Transpose this case into an electrical question, and it would be about as follows. The one gallon of water would represent one ampere of current. The friction resistance in the pipe would represent one ohm, and the one pound pressure would represent the electro-motive force (e. m. f.) necessary to drive the one ampere of current through a given length of wire having a resistance of one ohm.

The term megohm is formed simply by the addition of the prefix meg, or million, meaning, therefore, one million ohms.—*Scientific Machinist.*

CARE OF STEAM BOILERS.*

By Albert E. Edkins.

This is a subject which is (or should be) of deep interest to all engineers, not only for our own safety and our employer's property, but more especially for the protection of our fellow employees and the general public against loss of life and limb.

I have often thought that this matter does not receive from us that just and careful consideration that it should.

There might be much said or written on this subject in connection with the construction, material and setting of steam boilers. I shall, however, endeavor to keep as close as I can to my subject, touching only such points on the care of boilers as may be in my opinion conducive to safety and economy.

We know from experience that all boilers are gradually weakened by the work of destructive agents upon them from the time they are put into operation until they are discarded and carted away to the scrap heap in some rolling mill yard.

The rapidity with which this deterioration takes place depends to a great extent on the following: 1st. The quality of material and workmanship, 2nd. The location of boiler setting; 3rd. Last, but not least, the amount of care bestowed upon it by the man who is placed in charge.

One of the worst enemies of a steam boiler, with which we have to contend, is external corrosion, and it is to a great extent caused by negligence. This form of corrosion is often caused by the guage cocks, man holes, flange joints, tube ends, rivetted seams, &c., being allowed to leak and drip down the front and shell of boilers day after day where (oft times) "out of sight, out of mind," the plate is eaten away in a surprisingly short space of time to such an extent as to become dangerous. I notice that it is a very common thing to find the heads of boilers in the vicinity of the hand holes eaten away from the above cause. How often do we hear a man make use of such an expression as this after making a hand hole joint and finding it leaks a little, "*Oh, it's good enough.*" Every engineer in this room will agree with me when I say that there is nothing good enough for a steam boiler in the way of care and attention, unless it be the very best which the engineer has in his power to give.

The old saying, "As a man sows so shall he reap," is never more applicable than to a boiler in regard to the result of good, bad or indifferent handling as the case may be. Just as soon as a leak is discovered around a boiler it should be attended to, as if not it only tends to make matters worse, as I have before stated by inducing corrosion, as hot water and coal soot combined are corrosive agents of great strength and it is surprising how soon they will eat away the sheet to one-half of its original thickness. As I stated above this is a very common occurrence around hand hole doors and the plate is often found eaten away to such an extent as to need patching. I can attribute such cases as this to nothing but carelessness, as it can always be prevented by a little care and pains in making a joint. I have yet to find the hand hole that I can't make tight.

My way of making a hand hole joint is as follows. Clean the plate and sheet well, then wind about three turns of cotton wick tightly round the plate, cut a gasket of ⅛" rubber to fit plate snugly, then on top of it smear well with black lead or plumbago and oil. I never use red or white lead around a boiler except for pipe threads, and even for that I believe plumbago is the best. By using the black lead and oil on the rubber it can be removed at any time, and the gasket will adhere to the plate, having a smooth face, and can often be used three or four times. I have often packed so-called "hard ones" in this manner and made them quite tight when other means have failed.

For man hole plates I always use ¼" asbestos board cut to fit the plate snugly, then soak it in water for an hour, put it on the plate smearing the side coming in contact with the boiler shell, well with black lead and oil. Then when breaking joint again it will only be necessary to pour some water over the asbestos to soften it and apply more black lead and oil, and it is ready for use again. I have made joint for a man-hole in this manner which has lasted four years and been broken every three months. I believe this to be the cheapest joint for a man-hole plate, taking everything into consideration. Asbestos is a good steam packing, but I would not advise its use on water joints, such as hand-holes, as the water will soak through it.

We now come to the internal corrosion, which is another form of wasting away, but it is not quite so rapid as external corrosion when left to take its own course. The action of internal corrosion may be classified under the following headings, viz. Chemical, Galvanic, and Mechanical. It is chemical when seen in the form of the rusting away of plates in a uniform manner. When galvanic, its presence is made known by the rivet and stay heads being eaten away, also by pitting taking place in the tubes and sheets. We also find the ends of gauge glasses eaten away thin in some boilers from the same cause. Galvanism is a species of electricity which is excited by establishing contact or communication between two metals through the medium of a liquid and it possesses energetic decomposing power. Mechanical action, such as grooving and buckling of plates, is caused principally by unequal expansion and contraction. If we look into this matter a little it will not be hard to understand the cause of buckling and grooving. Take for instance an internally fired boiler such as the Lancashire or Galloway, and it is very evident that the difference of expansion between the furnace flue and the shell must be considerable, owing to the high temperature of the fire, and as the flue cannot expand very much endways on account of the rigidity of the heads, it has to adapt itself under these conditions somewhat to the shape of a bow, and it is from these actions that the grooving occurs in the roots of angle irons that secure the flue to the heads in this class of boiler. Mechanical action like the above frets and irritates the iron or steel until the skin is broken. The fracture is also acted upon by any acids which may be present in the water until the groove or fracture extends in many cases clear through the sheet. This action of grooving is frequently found, as I said before, around the roots of angle irons and flange plates of Galloway and Lancashire boilers, but is not found so frequently in the horizontal tubular boiler as commonly used in this country. A short time ago the writer saw some furnace flue angle irons taken out of a large Galloway boiler which were grooved the whole circumference with the exception of a space about 2 inches long.

The practice of some engineers of opening the furnace doors of boilers to check the generation of steam instead of having and using dampers cannot be too severely condemed, as leaky seams, rivet cracks, and other evils must follow such a practice, to say nothing of boiler maker's repair bills, and yet it is daily persisted in by some men.

It should be the aim of every fireman and engineer to keep the temperature of the furnace as near one point as practicable, if they wish to have a boiler free from leaks and thus reduce the sudden expansion and contraction to a minimun. The man who throws on a heavy fire and lets it burn up and die down until there is barely enough incandescent fuel to ignite fresh coal, and charges up his furnace again with green coal is not doing his duty either to his boiler or his employer as such slovenly work cannot fail, in time, to produce bad results to the boiler, to say nothing of such a course being uneconomical in the generation of steam.

In regard to internal corrosion, where it is uniform and in the shape of rusting away of the plates, I believe the best thing is to get a sample of feed water analyzed and a compound prepared especially to counteract the action of the corrosive agent or agents in the water. Fortunately for us we are not troubled much in this part of Canada by this form of corrosion. For the second form of corrosion, which is galvanic, I know no remedy, except to watch boilers carefully and have them inspected regularily, so that all defects may be discovered and made good before they become actually dangerous. In the case of pitting, which occurs mostly in low pressure heating boilers where the condensation is returned continuously to the boiler, I would advise that a few pounds of sal. soda be put in the boiler during the winter, and when laying up the boiler for summer, after washing it out thoroughly with hose and making all joints good, put in 10 lbs. of sal. soda and get up 3 or 4 lbs. of steam on boiler alone, then let boiler cool off and when cool fill up with water to the stop valve on main steam pipe. The above treatment will arrest the action of pitting, and in a damp place where a boiler stands idle all summer, after smearing boiler all over with coarse oil fill up with water and put in ten pounds of sal. soda dissolved and let it remain until the fall or whenever it may be wanted. This treatment will keep the boiler free from external corrosion caused by a damp cellar.

To guard against grooving and buckling, I would say, have

* Paper read at the annual convention of the Canadian Association of Stationary Engineers, Hamilton, August 29th and 30th, 1892.

enough boilers to generate the necessary amount of steam without having to force your fires, the effect of which is to shorten the life of your boiler and this to at the expense of economy in fuel. It is a mistake to put in two boilers of 100 h. p. rated capacity to do 250 h. p. actual work It would pay well in the long run to put in four boilers of 100 h p. rated capacity and run with slower fires and be in a position to shut one down at any time for cleaning There is no advantage in forcing a steam boiler, look at it from any point we may, but I am well aware that it is a very hard matter to get some steam users to regard it in this light as it seems to them always a matter of dollars and cents in the first cost.

I came across a case not long ago where a man boasted to me with apparent pride that the man hole plate of his boiler had not been removed since the boiler was put in, which is some nine or ten years ago, and that he only took out the hand holes and washed out once a year. When such men as this are allowed to control steam boilers, is there any need to wonder that week after week we read in our daily papers of boiler explosions and loss of valuable lives and property? Many people think boiler explosions are purely accidental and can't be avoided , I maintain that this is a mistaken idea, and I feel sure that if all the details of these explosions were known the cause would in many cases be traced to ignorance and negligence of the common sense rules which should govern the operation of steam boilers.

From the reports of the different boiler inspection and insurance companies of this and other countries, also of districts where an Engineers License and Boiler Inspection Law are in force and faithfully carried out, it is fair to assume that these boilers which have exploded during the past year would not have done so had they been inspected.

No boiler of the horizontal tubular type should be allowed to run over a month, when generating steam for power, without washing out, and the man hole should be removed at least every three months and the fireman go inside with scraping tools and dislodge all the scale and deposit he can, afterwards taking in the hose with him and washing off tubes and shell thoroughly. It is a good thing two or three days before washing out to pump into the boiler 10 or 12 lbs. of sal. soda, as this will soften the scale and make it much more easy to remove.

In case a boiler is badly scaled I have found the following a good course to pursue. when a boiler can be laid off for a few days, put in from 20 to 50 lbs. (according to state of boiler) of caustic soda and get up 60 lbs. pressure of steam, and keep it up for a day, then let steam down but keep enough fire going to keep boiler hot and water at 212° F. for a few days. Then let boiler cool down, let off water and wash with hose under good pressure, and repeat the dose if necessary. This treatment has been found to clean a boiler when everything else has failed. Some engineers are in the habit of blowing off a boiler under steam pressure and turning on the cold water to wash out while hot, as they claim by so doing it takes off the scale. That it does so is no doubt a fact, as the sudden contraction of the plates is so rapid that the scale is cracked and falls off. In following such a course a man may get off some of the scale, but the damage done to the boiler from such sudden contraction is such that it soon means a bill from the boiler shop for repairs.

The proper way to wash out a boiler is to let both boiler and brick-work cool down, if possible, then run off the water, and open up hand-holes, when the mud and sediment will be found in the bottom of shell and can be easily removed. After filling up the boiler with cold water put a slow fire under it and gradually warm it up. Forcing a heavy fire under a boiler full of cold water is as bad or worse than blowing off under pressure and washing out hot, and the engineer who boasts of having got up 20 lbs. of steam from water at 45° F. in 20 minutes, only shows his own ignorance.

Every man who has charge of steam boilers should take a pride in keeping them, and everything in connection with them, clean and in good order. He should be cool and collected in case of an accident, and not like a man I knew of a short time ago, who took a situation to run a small engine and boiler and when the second day, the guage glass broke, put for the street and could not be induced to go back until the engineer from the next door had been in and shut off the valves communicating with the boiler. Never allow any oil to enter your boiler. I am aware that many engineers believe that a little cylinder oil in a boiler is a preventative against scale, but be this as it may (and I am not prepared to contradict it), it is a well known fact to many engineers that very serious damage has been done to boilers by reason of oil mixing with the impurities held in the water and forming a kind of paste which in some cases has fallen to the bottom of boiler and remained there, and owing to the fact that this oily paste has kept the water from taking the heat from the plate, the result has been that the plate has been heated to such a temperature that the pressure has bulged the plate down, and in some cases a fracture has taken place. Some engineers will tell you they have allowed the oil from the condensation of exhaust steam to be returned to the boiler for years without any harm to the boiler, but I could tell you of places where it was only allowed to go in three months or so and the result was overheating of sheets, and when the sheets were cut out the oil and mud was found thick on the water side of sheet. The best cure for anything is prevention, and if the oil is being returned in condensation from your exhaust heating system to to your boiler, my advice is to take means to prevent it at once, or if you neglect to do so you may have trouble. It is a pleasure to go into boiler rooms where cleanliness is observed, not only on the brass mountings and fronts, but up over the tops of boilers, which in too many places serve as a lumber room for pipes, bricks, old bags and a large quantity of dust. A boiler should be kept as clean upon top as in front, and it is a very small matter to keep it so when once it has been put in that condition. The plea which is so often put forth by engineers as an excuse for a dirty, slovenly engine and boiler room, "*Oh, if it suits the boss it will suit me*," is about played out. The men who get on well are those who take an interest in all they do, are clean and tidy about their engine rooms, and put in their spare time reading and studying, in order that they may keep up to the times and be in a position to take advantage of a better position when it offers itself. It is this style of man who gets there every time.

This Association has been the means, both directly and indirectly, of bettering the positions of a good many engineers, and in so doing has been a benefit to quite a number of steam users, but I do not consider that the latter have given us that consideration and support which we were entitled to. Nevertheless we are gaining in this respect steadily, and shall continue to do so as long as our organization is based on a principle which recognizes the identity of interest between employer and employee, and the belief that true merit will bring its reward in the shape of good wages without the intervention of strikes and the misery which follows them, and which we in Canada are fortunately free from in their worst form.

Mr President, officers and brethren, I thank you now for your kind attention to the reading of the paper. I only wish I had the ability to handle the subject better. I trust that in the future several papers will be read each year, on subjects interesting to us all as engineers, as such papers cannot fail to be instructive, and will tend to prove to our fellow citizens and employers especially that we are endeavoring to keep up with the procession and to advance the cause of steam engineering.

PERSONAL.

Miss Yule, daughter of Mr John Yule manager of the Guelph Electric Light Co., left home on the 24th of October to spend a year with friends in Scotland. Her companions in the office of the company presented her with a kindly worded address and a valuable field glass as a parting token of their esteem.

Invitations have been issued for the wedding on the 7th inst. of Miss Emily Selina Ryan, of Newport, R. I., and Mr. John Carroll, Secretary-Treasurer of the Eugene Phillips Electrical Works, Montreal, and and Vice-President of the Canadian Electrical Association. The joyous event will take place at the residence of the bride's mother, 13 Bath Road, Newport. Taking it for granted that the bride is as charming as our fancy paints her, and knowing as we do the many excellent qualities of the groom, we extend to both our best wishes. Now that their days of "sparking" are over, may the future "current" of their lives flow smoothly and pleasantly on till the "circuit" of existence shall close.

The supreme court of Michigan has decided that a street car company which is not obliged by law to give transfer tickets, and which does not represent to the public that it will do so, may make its transfer tickets conditional upon being used within 15 minutes after being given.

THE TORONTO TECHNICAL SCHOOL.

Following is an abstract of the address delivered by Mr. John A. Duff, Principal of the Toronto Technical School at the opening of the second term on Oct. 3rd.:—

It has been announced that I am to speak to-night on "The Benefit of Technical Knowledge in Mechanical and Industrial Pursuits. It would probably be inferred that I would endeavor to ennumerate the advantages and advocate the claims of Technical Education in general, but I do not think that any one will be disappointed at hearing that such is not my intention, for I feel sure that everyone will be more interested in hearing what facilities for such education are provided by the Toronto Technical School, and by explaining the scope and bearing of the subjects taught I think I can more effectively than in any other way make clear to you the advantages to be derived therefrom.

The history of the Toronto Technical School is brief. In December of last year the City Council passed a by-law, appointing a Board of Management and giving them an appropriation of $6,000 and the free use of St. Lawrence Hall. The Board at once began the work of organization, teachers were appointed, and the courses of study decided upon, and St. Lawrence Hall having been found unsuitable, this building was secured and the necessary alterations made with such expedition, that by the first of February the work of the session was well commenced. The attendance from the first was large, and was well maintained throughout the term, and very satisfactory progress was made.

Such has been the past. There is every reason to hope that the coming year will be still more successful and that the Toronto Technical School will rapidly become a great power for the dissemination of scientific knowledge and habits of correct thought. With additional teaching power we have been able to make the course of study more comprehensive. Trigonometry will be taught twice a week instead of once, which was all the time we were able to devote to it last year, and, if necessary, the classes in Arithmetic and Measuration will be sub-divided. Arrangements have been made for three classes per week in Chemistry and Physics, which will enable us to provide a tolerably complete course on electricity—that mysterious power which seems destined to usher in a new era of civilization. There is thus provided for the current year the following distinct courses of study. Mathematics, including Arithmetic, Mensuration, Algebra, Euclid, Trigonometry; Practical Geometry, Descriptive Geometry, Mechanical and Architectural Drawing; Mechanics, including Statics, Kinematics and Dynamics; Chemistry and Physics, including Hydrostatics, Heat, Sound, Light and Electricity.

Each student is allowed to select his own studies subject only to the requirements of the time table. With only ten teaching hours in the week it is impossible to make provision for all the classes without having two different subjects occur at the same time, and thus to some exent the freedom of choice in the selection of studies is curtailed. The time table has, however been carefully arranged, so that the least possible inconvenience will be felt from this source For example, if a student has so far forgotten his Arithmetic that it would be necessary for him to take lessons in that subject, he would not be able, until he has become familiar with Arithmetical operations, to derive much benefit from the lessons in Mechanics. We have therefore put Arithmetic and Mechanics down for the same hour, and the students who find it necessary to review their Arithmetic, and who wish to study Mechanics, will find it not a hardship but very much to their advantage, to take Arithmetic during the present session and defer the Mechanics for another year. As the success of the student and therefore of the school depends largely on the proper selection of the course of study, let me briefly describe the different subjects taught, and incidentally mention some of the advantages derived from each.

Let us begin with Mathematics, the interpreter and herald of scientific knowledge, and without which little real progress can be made. Mathematics is one of the most potent instruments of scientific investigation, besides being the only foundation upon which exact scientific knowledge can be built. In Science and Engineering, theories are of little value unless they are exact and definite, and we cannot have this exactness without Mathematics. A knowledge of Mathematics is not necessary in order to understand the general laws of nature, but it *is* necessary in order to state those laws with exactness or make any practical application of them Anyone can understand that water will flow through pipes but no one can calculate the quantity which will flow through a given pipe in a given time without a knowledge of Mathematics. I do not mean to say that Mathematics must be pursued to its highest developments but it *is* necessary to have at least a good working knowledge of Arithmetic, Algebra and Geometry.

The course on Arithmetic—the corner stone of Mathematics—will comprise instruction in numeration and notation, the operations of addition, subtraction, multiplication and division, the use of fractions and decimals, ratio and proportion, the method of extracting square root and the theory of logarithms—in short a complete course in Pure Arithmetic, including all the arithmetical operations which are used in the other branches of Mathematics and Science, but excluding Commercial Arithmetic, which is the application of the forgoing rules to the computation of interest, discount, stocks, annuities, &c., and which finds its proper place in the curriculum of a Business College.

Along with Arithmetic are taught the rules of Mensuration, by means of which the areas of surfaces and the volumes of solids may be calculated and compared. A knowledge of these rules may be required by any man at any time or place.

In Algebra the work will be the same as that which is ordinarily taught in the High Schools of Ontario, which is all that is usually required in pure or applied science. I will not occupy your time with a more particular ennumeration, but I wish to impress upon all intending students the vital importance of Algebra in chemistry and physics. In these sciences formulae occur which can only be properly expressed by algebraic symbols, and the only practical method of solving problems or determining an unknown quantity is by means of algebraic equations. But if Algebra is of so great importance in Chemistry and Physics, it is absolutely indispensable to the proper study of Natural Philosophy or Mechanics. Very few calculations involving force or motion can be made without its aid, and without Algebra a knowledge of Mechanics must always prove to be incomplete and unproductive What has been said of Algebra is true to almost as great a degree of Trigonometry and Euclid's elements of Geometry. Euclid has the further advantage of being one of the most perfect systems of logic that has ever been constructed and no one can master Euclid without becoming a logician.

Let me here remark that the aim of higher education ought not to be so much to fill the student with dry facts, as to teach him how to use what knowledge he already possesses—in other words to teach him how to think properly and to act accordingly. And one of the greatest works that a Technical School can do is to teach mechanics the *art of thinking*. To do this there is no study so efficacious as Mathematics, for there is no other branch of knowledge so exact and definite, and there is no other in which the reason alone is employed.

In Chemistry, it is proposed to teach the mode of occurrence, the nature, and methods of preparation of the different elements and compounds which are of importance in everyday life, special attention being given to those substances and processes which are of technical value, such as electrolysis, coal, and the manufacture of coal gas, iron and steel, mortars and cements.

Lying in the border land between Chemistry and Physics, is the study of the constitution and properties of matter.—a few lectures will be devoted to his very interesting subject.

Under Hydrostatics will be taught the general character and properties of liquids, and the theory of the common hydrostatic and hydraulic instruments, such as the hydrostatic balance, hydraulic press, spirit level, hydrometers, electrometers, etc. Along with hydrostatics, though scarcely belonging to it, come the physical properties of gases and the atmosphere, the theory of the barometers, pumps, balloons and siphons.

The course on Heat will embrace the nature, sources, transmission and general effects of heat, the theory and construction of thermometers, the determination of the melting and boiling points, freezing mixtures, distillation and evaporation, and the theory of steam engines.

Lectures will be given on the elementary theory of Sound and Light in, which the theory and construction of optical and musical instruments will be described.

Electricity will be taught in two divisions. The relation of Chemistry to electricity, and the theory and construction of electric batteries, will be described in connection with the course on Chemistry. In connection with Physics, there will be a course on magnetism and current electricity, the theory and construction of the dynamo, telephone and telegraph, and the applications of electricity in daily life.

In Chemistry and Physics the lectures will be illustrated by experiment as far as our apparatus will permit. We hope that very soon, though perhaps not during the present year, there will be a laboratory in connection with the school, in which practical work in Chemistry and Physics may be done by advanced students. The advantages to be derived therefrom must be apparent to all, and let us therefore hope that it will soon be an accomplished fact. There will be a course on Practical Geometry, which is intended to give facility in the use of drawing instruments and the construction of geometrical figures. It will be found very useful as an introduction to the course on Descriptive Geometry or the theory of projection. That on Descriptive Geometry will comprise the representation of objects by means of a plan and elevation, and problems leading up to and solved thereby, such as the determination of the form of the intersection of two cylinders or cylinder and a cone, together with instruction in oblique and perspective projection. This course, which involves the theory of drafting, is of great utility not only to those who are trying to perfect themselves as mechanical or architectural draftsmen, but to sheet metal workers and any whose occupation requires them to have some knowledge of working drawings, as pattern makers, boiler makers, machinists, etc. In connection with the Descriptive Geometry, practical instruction will be given in the drafting room in instrumental drawing, lettering, etc., for which purpose copies and models of machine and building construction will be available. This instruction will be given to the students individually and for this purpose the drafting room will be open, and an instructor will be present during every teaching hour of the school. A student who takes this course of practical work in the drafting room should be able by the end of the year to read a a drawing without any difficulty, and also to make a fairly good original drawing, and at the end of two years he should be a fairly good draftsman.

The course on Mechanics will embrace the theory of vectors, the representation, measurements and laws of forces and motions, the theory of equilibrium, theory of the lever, pulley, and other simple mechanical powers, the calculation of stresses, theory of the simple beam, the transmission of force and motion, friction, work, energy, power, the efficiency of machines and the elements of machine design. I hope that this brief outline of the courses of instruction will enable intending students to choose wisely the subjects which they most require. But should there be any who are still unable to make a choice, the teachers will be glad to give whatever further information may be required. Most students will find that they will be unable to pursue more than two or three courses of study during the year. I would advise those who thus find it necessary to defer some of their studies, to take their Mathematics first, for the reason which I have already given, that a knowledge of Mathematics is essential to a proper study of the other subjects. From what I have said or from a reference to the prospectus it might be inferred that we expected to complete all our courses of study in one year, but such is not the case. In Algebra, Euclid, Descriptive Geometry, and perhaps some of the other subjects, two years will be required to complete the course, and it is expected that the advanced classes in these subjects will be formed next October. And, without interfering with the perfect freedom of choice now enjoyed by students wishing to pursue a special line of study, it is hoped that we will then be able to announce the programme for a regular course embracing two or three years. The experience of the past winter has convinced me that in Toronto the demand for technical education is urgent, but the citizens may rest assured that on the part of the Board of Management or the teaching staff of the Technical School no effort will be wanting to supply that demand.

SPARKS.

Six new vestibule cars and a sweeper are in course of construction for the Ottawa Street Railway Company.

The Ottawa electric street railway carried without accident during the recent exhibition in that city, 138,000 passengers.

It is proposed to increase the capital stock of the National Electric Tramway and Lighting Co., of Victoria, B. C., to $1,000,000.

A conductor named Snyder on one of the Hamilton electric street cars, was crushed between two cars on October 9th and fatally injured.

The Nanaimo Electric Light Works were advertised to be sold by auction on the 29th of October. The result of the sale has not yet been learned.

The wire, lamp and fixtures department of the Peterboro Electric Light Co. has been purchased by Mr. J. H. Greer, an experienced electrician.

The establishment in connection with the Ottawa University of a department for the teaching of electricity, is understood to be in contemplation.

The town of New Glasgow, N. S., has been asked to approve of a route for the electric street railway which the New Glasgow Electric Co. propose to construct.

The town council of Cote St. Antoine, has decided to grant a franchise for the construction of an electric street railway, to the Montreal Street Railway Company.

The Montreal Incandescent Light Co. are seeking incorporation for the purpose of manufacturing apparatus for electrical purposes. The capital stock is placed at $1,000,000.

The town of Chatham has granted the franchise to the local electric company, for the construction of an electric railway, and the right to furnish light and motive power to factories.

The vacancy on the board of directors of the Dominion Telegraph Co., caused by the death of Mr. Alex. T. Fulton, of Toronto, has been filled by the election of Mr. Hector McKenzie, of Montreal.

The St. Catharines electric street railway, which has been in liquidation for some time, was sold by public auction on October 22nd. Mr. George Dawson, of St Catharines, was the purchaser, the price paid being $20,000.

The telephone service in Toronto has been seriously affected by the heavy currents passing through the trolley wires. The difficulty will be aggravated when the electric cars are put in operation on Yonge street and the belt line. Meanwhile, the Bell Telephone Co. are pushing forward as rapidly as possible the work of putting their wires underground.

The generators that George Westinghouse is building to furnish electricity for the 93,000 incandescent lamps at the World's Fair are to be the largest in the world. One of them will operate 20,000 lamps. "The ordinary generator supplies but 1,200 lamps," Mr. Westinghouse said, "and most of them less. Our largest generator will supply 20,000 lamps, and most of the others will be of 10,000 lamp capacity each."

A file with which a young man named Black was engaged in filing a switch at the Toronto Street Railway power house, recently, came in contact with the positive and negative wires, with the result that a portion of the file was melted, and the young man severely injured. Had it not been for the fact that the file received a considerable portion of the charge, Black would not unlikely have been killed; as it was, he lost his eyesight for some days.

The city of Brantford, Ont., voted recently on the question whether it should operate its own lighting plants and the local system. The result of the vote was against the project. Such ownership would be an interesting experiment to watch, could it have been undertaken, because of its novelty, but the vote showed that the ratepayers of the city were not seeking any novelty. Municipal ownership of electric plants does not seem to be very popular.—*Electrical Industries.*

The Toronto Street Railway Co. are turning the building formerly used as stables, into a power house. There will be installed five compound engines, four of 550 horse power, and one of 325 horse power. These engines are to be placed in position in a few days. A chimney stack 120 feet high, the tallest in the city, is in course of erection. The power house is expected to be in operation by the first of the new year. The total cost of the plant will be about a quarter of million dollars.

PRICES FOR ELECTRIC LIGHTING IN BRANTFORD.

BRANTFORD, Oct. 29th, 1892.

Editor ELECTRICAL NEWS.

SIR,—Our attention has been called to a short editorial which appeared in your issue of this month, which doubtless refers to us. After a careful perusal of same, we are forced to the conclusion that some one with very little regard for truth has imposed on you.

We have had the contract for the public lighting of the streets of Brantford by electricity for five years, and although the penalties provided for in the agreement were as binding and harsh as they possibly could be, our company never once during the whole of that time received any notice from the city authorities that our lighting of the city was inferior, as alleged by you. And it is safe to say that they would have a better knowledge of the subject than either your good selves or your informants.

Tenders were called for in August last for another five years. Competition was keen. The Brantford Street Railway offered to light the city with sixty (60) lights more or less for twenty-six (26) cents per night, all night and every night; our tender was twenty-three and a half (23½) cents. Although the lowest, the majority of the City Council, for reasons that are familiar to us, refused to accept our or any of the other tenders, and submitted a by-law to the ratepayers asking authority to issue debentures to enable the City Council to go into the public lighting business. Our company and their friends fought the by-law and defeated it in every polling subdivision of the city. Every vote against the by-law was in favor of our company, and the action of the people is a rebuttal of your statement. The City Council then offered us the lighting for one year at 23½ cents per night, moonlight schedule, deducting from the 23½ cents per night every moonlight night, and this for only one year instead of five. The contract is now all night and every night. We had to accept these terms or be driven out of the public lighting business, and now you are disposed to allege that under the first contract we furnished inferior service, and on this account were driven into the position of accepting the present low figure. If we are to blame, with ample water power at our command, what have you to say about the offer of the Brantford Street Railway, owned now by the Canadian General Electric Co., of your city, who have to use steam power, and were very anxious to get the contract against a local company, at 26 cents?

Yours truly,

BRANTFORD ELECTRIC LIGHTING CO.

[As the above letter reached us only a few hours before going to press, comment thereon in this issue becomes impossible. We may deem it advisable to refer to the subject in our December number.—EDITOR ELEC. NEWS.]

PUBLICATIONS.

The Arena for November closes its sixth volume with a table of contents at once strong, varied and of general interest. This Review continues to grow in favor without lessening in a jot its bold assault on conventional shams and wrongs of the age. Nor does it show any sign of being less hospitable to new progressive and reformative thought. It is conspicuously fair and unquestionably the boldest Review of our time.

TRADE NOTES.

The Ball Electric Light Company report as recent sales, 750 light alternating dynamo and installation, two 50 light 4 ampere arc dynamos to Oshawa Electric Light Co., Limited, also 500 light alternating current dynamo and installation to Oakville Electric Light Co.; one 25 light 4 ampere arc dynamo to Wm. Stuckey, Grand Valley, Ont. Quite a number of the Ball Co.'s stationary motors have been sold this month in Toronto, London and Ottawa.

The first of a series of meetings of officers and employees of the Bell Telephone Co., in Montreal, to discuss matters affecting the perfect working of the system, was held recently in the ante-room of the main exchange. Mr. Miller, superintendent of the inspectors' department, presided. Mr. C. E. Getz, manager of the exchange, also took part in the proceedings. The means of overcoming the difficulties caused by induction from street railway currents were considered.

Cutting rubber for making gaskets or other purposes is always a difficult task when a dry knife is used, no matter how sharp the blade may be. It is said that if the blade be wet with water containing potash the cutting may be easily done with the exertion of much less strength. A thin blade, such as that of a case knife, is much better than a thicker blade, like that of a jack knife, and an easy way to sharpen a knife for cutting rubber is on a round or half-round file, which gives a saw tooth edge that is very effective in cutting rubber, leather or other tenacious material.

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EDITOR'S ANNOUNCEMENTS.

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

THE "CANADIAN ELECTRICAL NEWS" HAS BEEN APPOINTED THE OFFICIAL PAPER OF THE CANADIAN ELECTRICAL ASSOCIATION.

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TORONTO BRANCH NO. 1.—Meets every 2nd and 4th Friday each month in Room D, Sheltesbury Hall. W. G. Blackgrove, President; E. Phillips, Secretary, 63 Marlborough Ave.

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BRANDON, MAN., BRANCH NO. 1.—Meets 1st and 3rd Friday each month, in City Hall. A. R. Crawford, President, Arthur Fleming, Secretary.

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ST. LAURENT BRANCH NO. 2.—Meets 1st and 3rd Tuesday each month, in Mechanics' Institute, 204 St. James street. Matthias Guimond, President; Alfred Latour, Secretary, 306 Delisle street, St. Cunegonde

ON October 15th, two boilers in a rolling mill at Portsmouth, Ohio, exploded, wrecking the mill and injuring nine men. Four hundred men were at work in the mills at the time, and it is a wonder that not more were injured.

WE understand that the Bill which is proposed to be introduced in the Dominion Parliament at its next session, relating to the electrical interests, will cover the testing of electric light meters, an insulation test of the consumers' wires and regulations in regard to a constant supply of energy at the consumers' terminals.

A TELEPHONE circuit one thousand miles long has just been completed, establishing connection between New York and Chicago. The line has been tested and is said to work satisfactorily. There was used in its construction 50,000 poles,—fifty poles to the mile—on which are strung two lines of No. 8 copper wire.

BOILERS used for heating purposes are very liable to suffer from internal corrosion of the tubes. The use of the same water returning from the heating coils has much to do with it. The remedy is to change the water during the winter by occasionally blowing some off, and filling up with fresh water. A boiler should not be allowed to stand idle with the same water in it that has been used in making steam. If the water is to be idle, it is better to empty the boiler and fill up with fresh water.

WE referred recently to the fact that the advocates of the storage battery system of street car propulsion were endeavoring to create opposition to the trolley system in Montreal, in the same manner as was done in Toronto, and that the president of the Street Railway Company had offered to stake the sum of $5,000 on the result of the finding of an impartial committee of experts, if the storage battery advocates would deposit a similar amount. This offer does not appear to have met with any response, but to satisfy the citizens, the City Engineer was commissioned to visit Boston, and report on the merits of the storage battery system. In his report he publicly states his opinion that the storage battery as applied to the operation of street railways, does not fulfil the requirements. He believes that the trolley has come to stay, and that it will be found to work well even under the severe conditions imposed by winter in the Province of Quebec.

THE high rate of speed at which the electric cars have been run in Hamilton, has been the subject of remark by visitors to that city. Whether from this cause or otherwise, a number of accidents more or less serious have taken place. In the case of the last of these accidents, the coroner's jury, while attaching no blame to the mortorman or conductor of the car, recommended that the City Council should pass a by-law, to regulate the speed of cars to six miles per hour. In Toronto and elsewhere a similar suggestion has been made. It is one which in some respects, is open to objection. It might be made to apply to the smaller cities, where only short distances have to be covered, and to the central parts of large cities. In the case of the latter, it should not be forgotten, that one of the chief advantages of the electric system over horse cars, is its ability to carry passengers to their destination in less time, and if an arbitrary rule is to be applied which will regulate the speed of electric cars to that of horse cars, this great advantage of the electric system will prove valueless.

WE referred to the fact recently that the experience of the town of Toronto Junction with the operation of its own electric lighting plant, had proved to be unsatisfactory, the cost having been far in excess of what it would have been had the light been supplied under contract. The Town Council appears to have carried the experiment as far as is considered desirable, with the result that negotiations are now in progress for disposing of the plant to a private company. It is understood that an agreement for the purchase of the plant by the local street railway company, at the price of $18,000, under a 19 years' franchise had been almost concluded, when some additional privileges, such as the free use of water for condensing purposes and exemption from taxes, were demanded, which has been the means of reopening consideration of the question. It is rumored that a Toronto electric light comapny is also making an offer for the plant and franchise. The experience of Toronto Junction should serve as a warning to other municipalities who are thinking of attempting to do their own lighting,

CORROSION of metal is sure to take place if small leaks in steam boilers are allowed to go on. A large leak disturbs the supply of steam and alarms the man in charge, but little ones are often allowed to exist till the strength of the metal is diminished and explosion follows. Look out for the little leaks and have them stopped. The brickwork was removed from around a boiler in this city a few weeks ago, and on clearing away the dirt, about a dozen places were seen where the plates were eaten into small holes nearly through the entire thickness. The brick setting was not renewed around the boiler.

IN a recent issue, mention was made of the fact that the electric street railway in process of construction in the city of Montreal, would have to encounter severe difficulties in winter, owing to the large amount of snow and severity of frost which are the accompaniments of winter in that locality. This difficulty has evidently received careful consideration on the part of the management of the road, and the plan and means of overcoming it have just been decided upon. Mr. Everett, the managing director, states that it is the company's intention to begin at once the construction of one hundred sleds, which are to be used for the removal of the snow. There have also been purchased three powerful sweepers and a scraper. As soon as the snow begins to fall the company will at once put to work one thousand men to shovel it into the sleighs. Mr. Everett is of opinion that the company will succeed in keeping the streets sufficiently clear of snow and ice to enable them to continue traffic uninterruptedly throughout the winter. The attempt to accomplish this will be watched with no little interest by the citizens of Montreal, as well as those of other cities similarly circumstanced.

SEVERAL boiler explosions, attended with disastrous results to property and human life, have recently taken place in various parts of Canada. The most recent accident of this nature occurred a few days ago in the basement of one of the large business buildings in Hamilton. One of the large boilers used for heating the building exploded, wrecking a second boiler and setting fire to the premises. The fire department fortunately succeeded in putting the fire out. The boiler must have exploded under a very low pressure of steam, otherwise the results would certainly have been more serious. Occurrences of this kind emphasize the need for a higher standard of proficiency on the part of persons entrusted with the care of steam plants. Steam boilers in the hands of incompetent persons are almost as dangerous in the basements of buildings as a package of dynamite. The law should require persons who aspire to take charge of steam boilers to show by examination that they possess the knowledge which would qualify them for the position, and a penalty should be imposed on persons assuming the duties of such a position without having undergone examination. Unless some provision is made which will insure competency, we may expect to hear of disasters even greater than those which have already occurred.

ON the 4th of October, the United States Court of Appeals gave final decision in the case brought to establish Mr. Edison's claim to be considered the original inventor of the incandescent lamp. The case has been before the courts since 1885. The decision is favorable to the Edison claim, and will prevent the manufacture of incandescent lamps, except by arrangement with the General Electric Co., who are now the owners of the Edison patents. This decision will have an important bearing on the interests of those who have entered the business of manufacturing incandescent lamps, but viewed from their standpoint, will be much less serious than it would have been if the decision had been rendered shortly alter the case was commenced, owing to the fact that the Edison patents have now only about three or four years to run. The General Electric Co., recognizing no doubt that it would neither be possible nor profitable for them to attempt to do all the manufacturing of incandescent lamps, have expressed their intention of allowing manufacturers to continue business on payment of a fair royalty. There is no doubt that another effect of the decision will be to stimulate inventors to produce lamps which cannot be held to be infringement, of the Edison patents; indeed one of the leading competitors of the General Electric Co., the Westinghouse Co., of Pittsburgh, has already announced that it has succeeded in perfecting an incandescent lamp, which differs entirely in construction from those heretofore manufactured. Thus it would appear that the ultimate result of the decision just given by the courts, is likely to be advantageous to the manufacturers and users of incandescent lamps. In the meantime, the General Electric Co. will profit considerably by the monopoly granted them.

THE last annual meeting of the Canadian Association of Stationary Engineers, was the most interesting that has yet been held, and seems to have resulted in infusing new life into the organization. For the first time papers were read on engineering topics, followed by considerable discussion. This is a step in the right direction, and is following out the professed object of the Association, which seeks to be regarded as an educational factor. We observe that the relation of engineers in future to the electrical industries, came up for consideration. We have more than once pointed out that the care and operation of electric apparatus, in perhaps the majority of instances, will in future devolve upon engineers, that this is the time when engineers should be fitting themselves for the new duties which ere long they will be called upon to discharge, and that those who neglect to do so, will be relegated to inferior positions. The Association is no doubt working on proper lines in keeping aloof from trades unionism, and instead of demanding that its members, irrespective of qualification, should be paid a certain standard of wages, leaving the matter of salary to be settled between employee and employer, and devoting its attention to raising the standard of qualification of its members, so as thereby to enable them to command higher wages. The fruits of this policy are already beginning to appear. In numerous instances, those who have availed themselves of the means of improvement supplied by the meetings of the local associations, have been enabled to improve their positions. The fact of an engineer belonging to an association which is thus seeking to educate its members, is not likely to remain unknown to the owners of steam plants in the locality, and when a vacancy requires to be filled, they will naturally seek to fill it from the the ranks of such men. We think it would increase the interest in the Association if the meetings could be held semi-annually instead of annually.

WE note with a sense of gratification that there are several electric lighting companies who are making use of ⅝ carbon and a single lamp for all night lighting. As this is decidedly a step in the right direction we would be pleased to see the system more universally used. True the carbon must be of at least fourteen hours duration to last through the longest night; but as this is a matter that the manufacturers of carbons have accomplished, there need exist no fear of being unable to procure such a carbon. It is of great importance to those who may contemplate putting in an all night lighting plant to use the single lamp and ⅝ carbon, for by its use the cost of operation can be considerably lessened as compared with double lamps burning with 7/16 carbons. In the latter, three carbons are required for a 14 hours run, while in the former, but one and a half are necessary. Again, it is imperative that the double lamps be patrolled all night (if it is desired to give first class service) to keep them lighted, whereas with single lamps and the large carbons this is hardly required, at least not to such an extent. It is a well known fact that fully three quarters of the "outs" in 7/16 carbons are caused by "passed carbons," or in other words by carbons burning to a point and a heavy feed causing them to pass by one another and frequently lock, requiring the patrolman to set them back in their place before a light is again produced. This is not the case with ⅝ carbons. One reason is that they do not burn to a long point, and a flash on the dynamo or a heavy feed can only bring them down until they touch—they cannot pass by and consequently cannot lock, and the light cannot go out from these causes. We know of cases in which "carbon passes" on the ⅝ lamp were never known to occur, but with a 7/16 it would be a rare thing to find one lamp of a large number that had not this cause for being out recorded against it on more occasions than one, particularly if, as frequently happens, the carbons are slightly crooked. All things considered we feel we are but echoing the sentiments of the present users of ⅜ carbons when we repeat that in an all night lighting plant there is an advantage in their use.

In the Annual Report of the Chief of the Bureau of Steam Engineering of the United States Navy for last year, attention is called to the fact that from nearly every war vessel in service in the navy, reports had come of the inefficiency of the firemen, and of the insufficient number employed. The Chief points out that no matter how efficient the vessel and the equipment may be in every other department, failure in the boiler room spoils the whole. If during an action, when the fullest power of the machinery is required, unskilfulness on the part of the fireman should let the fires become dull or choked with ashes and clinkers, all hope of success would be gone. The report urges upon the Government the necessity of attempting to remedy this evil and to encourage the firemen in becoming skilled and expert in their duties. In all factories and establishments where steam is used there should be more attention given to this very important subject. In these days of competition profits can be made by skill and care in saving. Begin here, not as is too often done by employing the man who is willing to work for the lowest wages, but the man who can earn good wages by skill in the use of the coal shovel. A few years ago a certain flour mill in Canada was closed. The engineer was ordered to dismiss his staff of firemen. In about three months the mill was again started, but the firemen had gone elsewhere looking for work, and the old hands could not be found. With the same engineer and same machinery, but with new firemen, twelve tons of coal per day were required to do the work formerly done with nine tons. Here a change of firemen increased the fuel bill by 33⅓ per cent.

A case has come under our observation quite recently in which an existing electric light company was about to purchase a power generator for the supply of power to numerous small manufacturers and in which there existed the doubt as to whether it should be of 250 or 500 volts E. M. F. Eventually the 250 volt generator was given the benefit of the doubt. It may be pointed out to those similarly situated, that for many reasons, the 250 volt machine is undoubtedly the proper one to install. The principal reason is that it is absolutely safe to handle a current of this voltage. As the current is required to be carried into buildings and rooms in which there are quite a number of employees, this safety in handling becomes most imperative, for while there may be but one person whose duty it will be to handle and take care of the motor, there will likely be some inquisitive young person about the place who when opportunity offers will try his hand at it, and ten chances to one receive a shock, if it is possible to do so, before he gets through. If a low tension current is used it can do no greater harm than frighten, whereas if it were of 500 volts potential and contact were made with it for any length of time, it might not only cause a severe shaking up, but serious results would in all probability follow. True the cost of constructing the line will be much greater if 250 volts are used than it would be with 500 volts. Another point to consider is the lesser liability to short circuiting of the lines from any cause, for with the 250 volt circuit there will only be one half the risk of serious results following such short circuit; an arc of any length cannot be maintained; whereas with 500 volts it is quite easy to produce and keep going such an arc as would cause damage to the machine or some of its parts, or set fire to the building if not checked promptly. We are of the opinion therefore that the 250 volt circuit possesses an element of safety quite superior to that of the 500 volt, and is the only one that should be used for supply of small motors that are liable to be used in all manner of places and under all sorts of conditions. We cannot condemn too strongly the practice of connecting such motors on a grounded street railway circuit, as is done in some places. With 500 volts and a grounded circuit, it becomes absolutely dangerous, and should not be handled by other than a practical man at any time, much less should it be placed in a position to be handled by those who perhaps have not the faintest conception of the danger lurking therein. It is not the purpose of this article to make it appear that a 500 volt circuit is what is recognized as a dangerous one, for such is not the case, but we feel that we are not over-stepping the bounds when we again repeat that contact with a grounded 500 circuit is dangerous, particularly if such contact is made for any length of time.

CENTRAL STATIONS OPERATED BY WATER POWER.

Mr. George A. Redman writes on the above subject in the columns of *Practical Electricity* as follows:

The adaptation of water power for electrical purposes has grown very rapidly within the past few years: there are several causes operating to enhance the value of water power, none more so than that of electricity.

Streams that have had no pecuniary value heretofore are now being utilized for the purpose of running electrical machinery; yet at the same time the supply of water is diminishing, caused by the destruction of forests, and water right owners in various parts of the country are devising means of storing water during the rainy seasons to furnish a supply during the dry season; also storing it in the daytime for night use. One large water right owner in Western New York, during the months of July and August, places flash boards two and one-half feet high on top of his dam, at an expense of $100, and stores up for night use the water which is not necessary for him to use in the daytime, thereby saving in the two months a coal bill of $2,100.

The Johnstown, N. Y., Electric Light Company have improved their water power at the Cuyadota Falls by erecting a dam 34 feet high on top of the falls, giving them a total head of 75 feet and nearly doubling the amount of power.

A survey of the upper Genesee River, between Mount Morris, N. Y., and the celebrated Portage Falls, has been made during the past year, for the purpose of establishing a reservoir that will furnish the city of Rochester 30,000-h.p. more daily during the entire year, than they have at present.

The earliest forms of water wheels were the paddle and flatter wheels, that only utilized the impulsive action of the water; these being followed by simpler wheels of the reaction type, and others.

We now have the improved forms of the Leffel, Victor, Lesner, Success, and many others. There is a demand for the best and most economical turbine that can be manufactured.

Turbines should be built to secure the delivery of the water upon the turbine without checking the velocity of the water more than one-third, and to permit the free discharge of same after passing through the turbine, and to work with as good efficiency under part gate as under full gate, and to be made of the best phosphor bronze, to stand the wear and tear under high heads.

It is essential in locating central stations to be run by water power, to locate them where there is no great danger of a flood, or so protected by a breakwater as to make it perfectly safe, and also to avoid trouble with backwater upon the turbines. Where a station is situated on the bank of a river, it is best to take the water from the river by means of a raceway, with the headgates parallel with the flow of the water; and at times of a freshet or running of anchor ice, it will more than pay any expense incurred by so doing. The raceway should be of a sufficient depth and width to permit the water to flow not more than 90 feet per minute, and a waste gate should be placed in the side or end of the race to use in case of emergency; and when cleaning out the raceway a rack should be built across the race to prevent driftwood and other rubbish from passing into the turbines. For that purpose I recommend a rack built of iron slats two inches wide, one-eighth of an inch thick, and placed five-eighths of an inch apart on seven-eights inch iron rods, at an angle of 45 degrees. Particular attention should be taken to keep the rack clean by raking. A trough or platform should be placed over and immediately back of the rack to rake the rubbish and anchor ice into, and so arranged that the current of water from the race will pass through the trough and carry off all of the rubbish, etc. For any station that is using 100 h.p., or over, it will be a great saving in labor to them and pay well for the extra expense. For winter service a boom should be placed in front of the headgates, and the current will carry off a large portion of the anchor ice and other floating objects.

The headgates should be built to work with a rack and pinion;

also a roller should be placed back of each gate stem to facilitate the handling of the gate. The gates should have a protection built over them, to protect the gearing from the storm. In a cold climate, where the gates are apt to be frozen in, salt is essential in freeing them from ice. All headgates and timbers should be of the best quality of oak, and should be well bolted, and not less than two gates to one raceway. The tail race should have no less than two or three feet of dead water when the wheels are not in motion. Where the tail race runs under the station, cement floors should be laid, to prevent moisture in the station; a floor of that material will soon pay for itself. Vertical turbines should be placed so that the steps are covered with water at all times. In adapting turbines to very high heads, or to conform to location, it becomes necessary to set the turbines above tail water, and conduct the water away from the turbines, through a draft tube.

THE SUPPLY OF CURRENT BY METER.

By T. P. Wilmshust.

THE method of charging for current adopted by the Yorkshire House-to-House Company, as published in *The Electrician* of the 30th ult., raises a question of some importance. A large number of supply companies have adopted the plan of allowing sliding scales of discounts to consumers, and of those who have no such published tables the majority find it expedient to make to their larger customers a substantial reduction of price, based on the quantity of current used.

The system in vogue is to allow a rebate to a consumer after a certain number of units have passed through his meter, irrespective of the number of lights that consumer may have. This, though undoubtedly the simplest method, is by no means an equitable one. Take the following instance. A customer, A, has 100 lamps which he uses an average of one hour per day throughout the year; B has 10 lights, and uses them 10 hours per day throughout the year. The number of units consumed by each is the same, and hence each receives the same rebate. B, however, is a far better customer to the supply company, for he helps to equalize their load curve, and only requires the use of one-tenth of the generating plant that A does.

To obtain a more even distribution of this load curve throughout the 24 hours is the fervent wish of central station officials. It was predicted that the more extended use of motors would bring about this happy result; but, unfortunately, it is found in practice that the hours of motor load overlap the hours of lighting load. One company, I believe, actually proposes to influence the lower parts of the curve by flooding the market with such apparatus as electric griddles, electric curling-tongs, and the like.

The simplest way out of this uneconomical state of affairs is, in my opinion, the application of an equitable system of rebates, which shall operate not simply on the numbers of units consumed per annum, but on the number of units consumed *per lamp* per annum. This will place the consumer with a small installation (but who wishes to use his light freely) on an equal footing with the consumer with a larger installation. Bearing these points in mind, the following table has been worked out for use at the Exeter supply station :—

Cost to a consumer of a 30-watt lamp in use for 365 days for the hours named in first column, at a sliding scale charge of—

7½d. per unit up to 12 units, 6½d. about 12 and not exceeding 16, 5½d. above 16 and not exceeding 20, and 4½d. above 20.

Hours of burning each day.	Units used per annum per 30-watt lamp.	No. of units at 7½d.	6½d.	5½d.	4½d.	Annual cost under sliding scale. £	s.	d.	Average price paid per unit.	Price if at 7½d. £	s.	d.
1	10.95	10.95	...	...	...	0	6	10½	7½d.	0	6	10½
2	21.9	12	4	4	1.9	0	12	3	6¾d.	0	13	9
3	32.85	12	4	4	12.85	0	16	4½	6d.	1	0	7½
4	43.8	12	4	4	23.8	1	0	6	5½d.	1	7	6
5	54.75	12	4	4	34.75	1	4	6	5¼d.	1	14	4
6	65.7	12	4	4	45.7	1	8	7	5.2	2	1	0
7	76.65	12	4	4	56.65	1	12	8	5.1	2	7	9½
8	87.6	12	4	4	67.6	1	16	10	5.05	2	14	9½

—*The Electrician.*

One of the most interesting features at the recent exhibition in Ottawa was the heating apparatus invented by Mr. Ahearn. The visitors were enabled to witness the baking of bread and the heating of buildings by means of the electric current. The tea and coffee supplied from the lunch rooms were also heated by the same means.

BOGUS BOILER INSPECTORS.

TORONTO, Sept. 21st, 1892.

Editor ELECTRICAL NEWS.

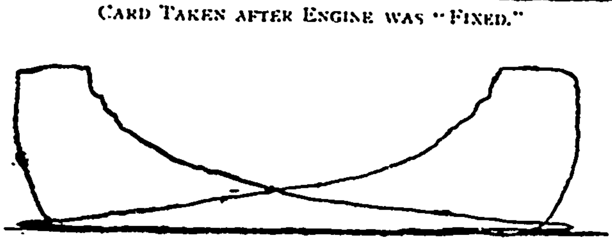
DEAR SIR, In a city not 100 miles from Toronto there is a flourishing manufacturing concern, at the head of which is a man who is very wise in his own estimation. A few weeks ago it was decided to shut down this establishment in order to put in new machinery. The manager decided that this would be a good chance to have the boilers inspected, and, with this end in view tried to make arrangements with a boiler inspector to make an inspection of his boilers. For some reason best known to themselves, the proprietor could not induce the inspector to make the examination, and he at once commenced to look around for someone else. He was not forced to look long; a man came along one day who claimed to have the necessary ability and experience to examine a boiler in the most scientific manner. He was at once engaged for the job, and was to give a written report as to the condition of the boilers.

The engineer had everything in readiness for the "Inspector," who turned up on time, and after much talk about what he knew of steam boilers, commenced operations. He went in at the manhole of one boiler, and, in a few moments came out and announced that he had found a hole in the boiler, and that the brickwork along the side with the hole in it must be taken down to enable him to examine the hole externally. The brickwork was taken down, and the hole, which turned out to be a one inch plug, was examined, to the evident disgust of the "Inspector" and owner. The side of the boiler had been tapped to attach a pipe for some purpose. The "Inspector" had seen the hollow spot in the plug which had been screwed in, and pronounced it a hole in the sheet. Of course the brickwork had to be made good again and the owner had rightly enough to foot the bill. This man who was proclaiming himself a boiler inspector turns out to be a cross between a blacksmith and tinker or something of the kind.

I could relate another case where a tramp called on a concern and succeeded in persuading them that their engine was working very uneconomically, and that he was just the man to fix it. In fact he represented himself as an inspector from Messrs. Goldie & McCullough, and said he was going around the country adjusting the valves of their engines. He worked on this engine, which was a Corliss, all Sunday, and "fixed it" as he called it. On Monday he called early and took away twelve good dollars of the firm's money for his services.

The engine did not appear to be right, but the foreman thought she must be in good shape as Messrs. Goldie & McCullough's inspector had fixed her up. However, the superintendent made up his mind to have the engine indicated, and an engineer was sent for. The first card taken off that engine after the "fixing" is shown below, and must be pronounced a "daisy."

CARD TAKEN AFTER ENGINE WAS "FIXED."



CARD TAKEN FROM ENGINE AFTER ADJUSTING VALVES.

This should prove a warning to steam users to look out for tramp engineers. If an engine is out of order, let them employ a reliable man to put it in order, and not squander their money on the first loafer that comes along.

Above all, lookout for a genius purporting to be an inspector from Messrs. Goldie & McCulloch. If Messrs. Goldie & McCulloch had an inspector to examine their engines, he would carry an indicator and use it, and would not lounge around hotels for two or three days at a time, an example of the effects of too much "fire-water."

Yours truly,

DASH POT.

THE ARRANGEMENT OF STEAM PIPES.

WE have, from time to time, called attention to the importance of suspending and securing steam pipes properly, and providing for their expansion and contraction. In this article we wish to call attention to a common but dangerous method of connecting boilers with main steam pipes.

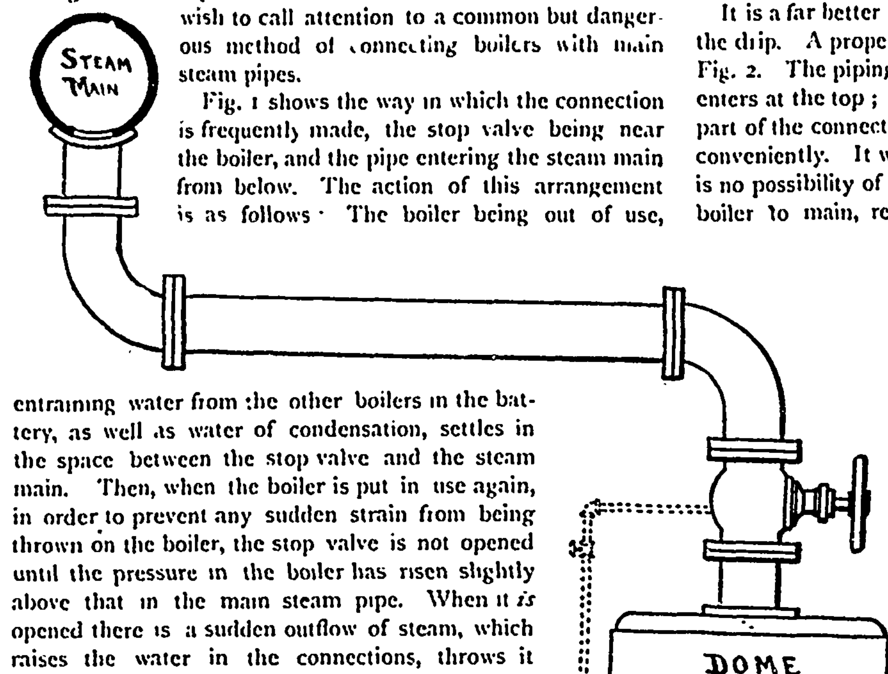


FIG. 1.—A DANGEROUS MODE OF CONNECTION.

Fig. 1 shows the way in which the connection is frequently made, the stop valve being near the boiler, and the pipe entering the steam main from below. The action of this arrangement is as follows: The boiler being out of use, entraining water from the other boilers in the battery, as well as water of condensation, settles in the space between the stop valve and the steam main. Then, when the boiler is put in use again, in order to prevent any sudden strain from being thrown on the boiler, the stop valve is not opened until the pressure in the boiler has risen slightly above that in the main steam pipe. When it *is* opened there is a sudden outflow of steam, which raises the water in the connections, throws it against the first elbow, and, if that does not break, hurls it the full length of the horizontal pipe against the second elbow, and then up into the main steam pipe. The shocks so produced are greater than would be imagined by one who has not had experience with water-hammers. In one case that came under our observation recently, *three* elbows were fractured in succession from this cause. When the first one broke the superintendent of the mill considered that there must have been a flaw in it. It was replaced by another, which lasted only a few days. A third elbow was put in, with a precisely similar result, and by that time the superintendent had become satisfied that something was wrong with the arrangement of the piping. The defect was pointed out to him, the pipe was re-arranged, and there has been no trouble since.

It might be said that the stop valve should be opened when the pressure in the boiler is just *equal* to that in the main. This is true, but it is not easy to determine, with any degree of precision when these pressures *are* equal and the engineer very properly prefers to err on the safer side, and have his boiler pressure a trifle too great, rather than too little.

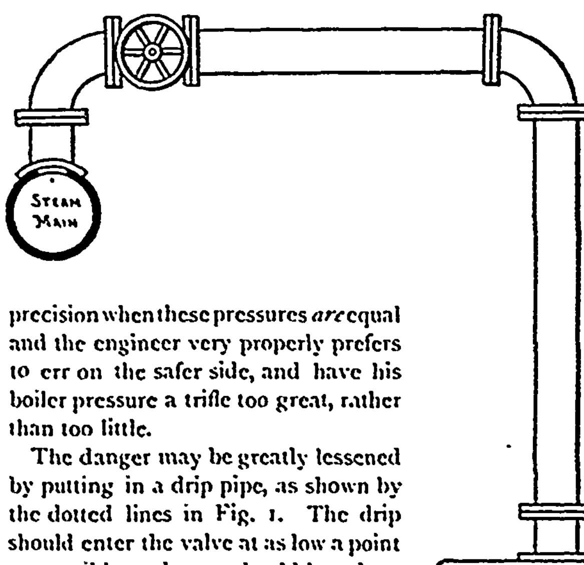


FIG. 2.—A SAFE MODE OF CONNECTION.

The danger may be greatly lessened by putting in a drip pipe, as shown by the dotted lines in Fig. 1. The drip should enter the valve at as low a point as possible, and care should be taken, when the idle boiler is about to be thrown into use, to blow *all* the water out through the drip pipe immediately before opening the main stop valve. If this were carefully attended to each time, the arrangement of piping shown in Fig 1 should give no trouble; but it is a matter of every day experience to find engineers, who perhaps do not fully recognize the importance of the drip pipe, growing somewhat careless about it. After they have used it conscientiously fifteen or twenty times, there is a tendency to slight it a little, and open the main valve before the water is all out. If no trouble results, this is apt to fix itself on the man as a habit; and some day, when he is in a hurry, he may pay no attention at all to the drip, but open the main valve at once, exposing himself to the danger described above

It is a far better plan to fix the pipe right, and do away with the drip. A proper arrangement of the connections is shown in Fig. 2. The piping passes up above the steam main, which it enters at the top; and the stop valve is placed in the horizontal part of the connection, and as near the steam main as it can be, conveniently. It will be seen that with this arrangement there is no possibility of trapping water. The entire connection, from boiler to main, remains dry, and no water-hammer action is possible. Fig. 3 shows another way of arranging the connection so as to avoid the trapping of water. In this arrangement the pipe enters the steam main at the side, the elbows are done away with, and an angle valve is used to connect the horizontal and vertical pipes. A perspective view of this method of connection was given in *The Locomotive* for May, 1892, on page 66. When new work is being put in, we usually recommend the arrangement shown in Fig. 3; but if the piping has already been put up, in the manner shown in Fig. 1, or in any similar manner that involves the same element of danger, the arrangement shown in Fig. 2 is cheaper to put up, because it enables one to use the same valve that was in use before.—*The Locomotive.*

EXPERIMENT WITH A STEAM BOILER.

THE author of a paper read to the Institute of Civil Engineers has been experimenting with a boiler:—

In calculating the evaporative capacity of boilers, it is usual to reckon it at so many pounds per square foot of heating surface. But the author is of opinion that this method is not sufficiently accurate to determine the maximum evaporation at any given point, since evaporation is not and cannot be uniform throughout a boiler. A boiler becomes overheated at its hottest part, that is, the part subjected to the greatest heat, and the largest quantity of water will be here evaporated. To study the phenomena of overheating, the effects of heat at this particular point, and the amount of evaporation from it must be determined. The author isolated a portion of a boiler plate immediately above the bridge, where the heat is known to be greatest and overheating most frequently takes place. He placed upon it a small vertical iron tube, which was firmly bolted to the bottom of the boiler; the top of the tube rose above the level of the water and opened into the steam. The tube was fed through a separate pipe with water at the same temperature as that in the rest of the boiler, and the quantity of water evaporated by this limited area of heating surface was carefully measured.

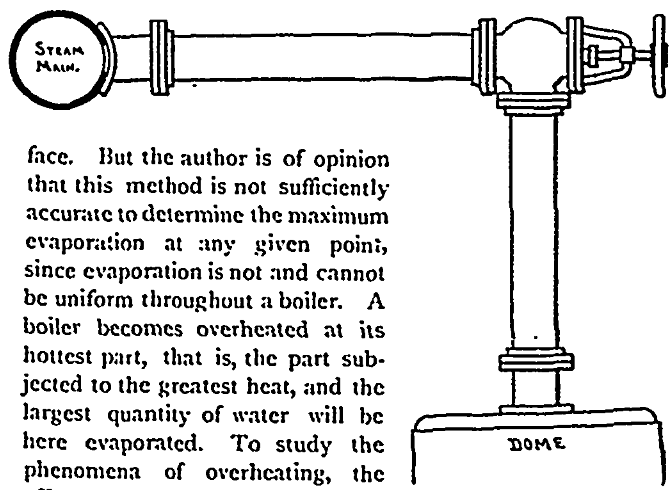


FIG. 3—ANOTHER SAFE MODE OF CONNECTION.

The experiment was made on a cylindrical boiler, with four separate lateral feed-water heaters. The boiler was 10 feet long, and 2 feet 2 inches in diameter, with a heating surface of 35¾ square feet; heating surface of the feed heaters, 107½ sq. feet; total, 142¾ square feet. The grate surface was 3.85 square feet, and a blower increased the draft when a stronger fire was required. The small experimental tube was 4 inches in diameter, with a heating surface 19.3 square inches, bolted to the boiler, and the joint made with asbestos and india rubber. The tube was connected to the water gauge of the boiler, and the same level of water maintained in both. Previous to an experiment the boiler was heated for several hours, and communication was then cut off between it and the experimental tube. During the trials the pressure in the boiler was kept at about 60 pounds. The fire was stoked as usual, the consumption of coal noted, and the total evaporative power of the boiler determined.

With different intensities of fire, the consumption of coal per hour per square foot of grate varied from 16 pounds to 48 pounds. The author, however, does not advocate such excessive duty, and considers that any consumption of coal above 30 pounds per square foot of grate represents a rate of firing inconsistent with the safety of the boiler. As a rule, with stationary boilers having the above proportions of heating to grate surface, from 1.6 pound to 2.4 pounds of water are evaporated per hour per square foot of total heating surface. Here the maximum evaporation was 94 pounds, and the minimum 19 pounds, or from two to four times as much as in a locomotive boiler. Evaporation was extremely active from the portion of the boiler surface covered by the tube, varying from 30 pounds to 49 pounds of water per hour per square foot of heating surface with moderate firing, and from 40 pounds to 48 pounds with strong firing. The forced draft increased combustion but not evaporation. The author concludes that, with stationary boilers working under ordinary conditions, evaporation at the part most exposed to overheating ought not to exceed 20 to 28 pounds of water per square foot of heating surface per hour, and never attain to pounds in practice.

NEW TECHNOLOGICAL BUILDINGS, MONTREAL.

The new Technological Building in connection with McGill University, Montreal, is a most substantial structure, and its perfect adaptability to its purpose, evidences the painstaking thought bestowed upon it by the designer. The various parts of the building are isolated from one another by fire-proof doors. They include draughting rooms, pattern rooms, machine shop and blacksmith shop, each fitted with the appliances necessary for imparting instruction of a practical character to the students, and one of the best equipped testing laboratories in the world. This laboratory contains two testing machines, representing the most perfect English and American patterns, each with a capacity of 100,000 pounds. These machines are operated by means of a small electric motor. They are capable of determining both the tensile and crushing strength of materials. The laboratory also contains a chemical balance capable of weighing 125 pounds or the fraction of a grain, a *fac simile* to a small scale of the Montreal water works, by which the head of water necessary to supply a given population may be determined; apparatus for measuring the volume and rate of flow of water in a running stream, etc.

Here may also be seen the only standard cement testing department in Canada.

Other features of interest are the electrical department, which contains a 250 h. p. dynamo driven by a sixty h. p. engine. There is not a belt in the place, the dynamo being driven straight on end. There are two engines each 500 h. p., and the space occupied by each engine is only 5x9 feet. The bottoms of the engine beds are hollowed out, which has the effect of preventing rocking. This department is in charge of Prof. Workman, and possesses every facility for imparting electrical knowledge of a theoretical and practical character.

One of the most interesting and valuable features of the institution is the library, which contains 6,000 volumes of scientific books, being one of the most complete libraries of its kind in the world.

At the top of the building, enclosed in glass, is a museum of mechanical models, which for completeness is said to be unequalled anywhere in the world. These models are the work of a celebrated German maker named Releaux, and were many of them made expressly for this institution. They illustrate almost every conceivable mechanical movement, and will be of great service, not only to the students of the school, but also to manufacturers and inventors. They are valued commercially a $8,000.

The Physics building, which is as yet incomplete, seems likely to be as perfect in its arrangement and appointments as could be desired.

TESTING DYNAMOS.

By Forrk Bain.

Electric business generally is done in a most unbusiness-like way. A purchaser orders of the manufacturer a dynamo of the desired capacity; the purchaser gets the machine into position, puts the belt on, turns the switch and off she goes - that is, if she goes at all. If the dynamo does not start off immediately and bring all the lamps and everything else in the circuit up to the expected point of excellence, or if, from some similar cause, the dynamo doesn't "generate," it is at once condemned. The cause of the trouble may be an open circuit, or it may be the connections are not made correctly.

There are a great number of reasons why a dynamo will not always start up at once and all of the reasons should be looked into before judgment is passed. I have seen engineers spend weeks to find the "pound" in their engine and they did not "damn" the man that made the engine because it pounded. An engineer knows that there is a reason for it, and sets to work systematically to find the cause. But let a dynamo get out of order, and this same man will lose his head at once. I once went 150 miles to put a brush down on the commutator of a dynamo. An engineer of a certain plant in a large establishment in a sister city had been running a 1200-light incandescent plant for more than a year. Finally when he started up one night one of his dynamos would not "generate." He had "looked everywhere for the trouble," and gave it up. I was sent for, and in a few moments, by a little systematic testing, discovered that the upper brushes did not touch the commutater by a small fraction of an inch. The stem on which the brushes were mounted had become slightly loose and had turned back enough to lift the brushes from contact with the commutator. The brush holders were of the kind having a limiting stop each way. The remedy was, of course, very simple. The trouble could have easily been found by the engineer had he used a little "horse sense" and as I have before said a little systematic testing; I do not always mean by this, a series of guesses, but tests based upon sound judgment. Go off in a corner and think it out, but do not hop around and try a dozen different things without knowing the reason why you are doing them. It is seldom that trouble of this kind is cured accidentally.

I went to Milwaukee one time to find the trouble with a large Brush Arc machine. The dynamo man said he had not been able to find the trouble, and that it had not worked for three days. It seems incredible when I relate the cause to have been that one section of the commutator had been removed and was missing. How the man in charge could have failed to discover it is more than I can understand, but he was ignorant of the fact until I pointed it out. If I thought it would make interesting reading I could relate, I venture, at least, one hundred as ridiculous cases as these, where a little thinking and a general knowledge of the machines in charge could have saved time and money to the owners. I will not attempt in this article to describe how these tests should be made in order to locate trouble, for there are hardly any two cases alike. It will therefore be necessary to adopt a systematic method which I will endeavor to present at another time. There are two sides to every story and the engineer or dynamo men are not always to blame. The owners of plants should not look to them for all the trouble that occurs until they have first performed all they should before the plant is given into their hands.

Every plant that is put in should be tested, "received" and accepted by an independent and competent electrical engineer, one who is in business for himself and expects to remain so, so that he could give a fearless and honest opinion to his employer. He should closely examine the dynamo for capacity, insulation, continuous run, efficiency and an important and often overlooked quality, mechanical construction. And then come in a number of minor features which should be looked after: inductive velocity of the armature—it may be greater on a drum than in a ring armature; rise of temperature on full load should receive close attention; hysteresis and foaucault currents are much more noticeable in badly constructed and proportioned machines than is usually suspected. I have known a case where these two ever present evils have absorbed more than ten per cent. of the power of the dynamo. The heating of switch contacts and other joints should be noted, the resistance of the circuits as a whole, and in sections, should be measured. In fact, every condition should be carefully noted. If the dynamos are compounded, see that the rise with load corresponds with this loss in line, also be careful to note if there is more than one compound dynamo, whether the equalizer is large enough. The resistance of the equalizer should not be less than one-half the resistance of the larger armature.

There are numberless points of this kind that should be carefully inspected by a competent man before a plant should be accepted, and I believe that if owners understood more of the importance of these seemingly little points —but, in fact, very important factors to the success and economical maintenance of every plant—that there would not be so many butchers in the business manufacturing electric light apparatus to-day.—*Electrical Industries.*

The blue glass insulators, heretofore used on telegraph wires, have always had an attraction for the stone throwing boy, and in consequence, a considerable loss has been entailed on the companies. The experiment has been tried of substituting for the blue glass, insulators of an inconspicuous shade of color, and the result is highly satisfactory. The breakages have thereby been reduced by about 50 per cent. As the result of the experience thus gained, the companies will hereafter use only insulators of the kind last mentioned.

RECENT IMPROVEMENTS IN ELECTRIC TRACTION.

A committee appointed to deal with the above subject reported to the Street Railway Association of the state of New York at last convention as follows:

We understand anything which tends to an increase of reliability or economy of operation of an electric railway to be an improvement, and it is with the intention of bringing before you in a brief manner the results of my experience and observation during the past year, upon these points, that this article has been written.

As you of course know, electric systems as first constructed were built on altogether too light a plan, and the increasing tendency year by year has been, and is, for heavier and more solid construction in every department, but particularly in the way of track station equipments. It has been well said that no new departure is ever perfect at the beginning, and no one realizes this more than he who has watched the development of electric traction during the last few years.

The storage battery has made but little progress during the past year and is not likely to cut much of a figure in electric traction until it is able to make better showing, financially, than it has in the past.

It may seem strange that the management of roads, even at present operated by horses, cannot see that a change of some kind must come soon owing to the great cry for rapid transit, and yet I know of roads at present being laid with flat center-bearing rails on stringers in streets being newly paved. I do not mention this as an improvement, but simply to show that what may be regarded as an improvement by some would be called simply a makeshift or temporary piece of work by others.

The general tendency of the times to consolidate all common interests under one management is showing its efforts in electric traction more now than ever, and scarcely a week passes that we do not hear of some syndicate obtaining control of some horse road, and the information usually ends with the statement that "it is intended to equip all the lines with electricity." From many points of view this is an improvement, and a marked one.

TRACK.

The improvement in track construction has been very great, and, although many expensive errors have been made, we ought, on the whole, to feel satisfied with the progress.

The early forms of track construction were tyo light and soon went to pieces, but during the past year heavier rails have been rolled and better joint plates made, so that it is possible to keep the road bed in perfect line and surface. This improvement has been a great help to the electric equipment and has reduced the cost of maintenance. As the cost of laying tracks is about the same, whether light or heavy, it is economy to put in only the best.

Now, on the question of what constitutes the best form of track there is considerable variance of opinion My experience and observation has convinced me that the deep girder rail, about nine inches high, spiked directly to the ties, is the best form for paved streets, and, in dirt or Macadam streets, a six-inch girder rail laid in the same manner. In the country where the local authorities are willing, I would lay a tee rail spiked directly to the ties.

The weakest place in all forms of track construction is at the joint. Every manufacturer of rails, and many of the railroad companies, have tried to overcome this trouble. There are probably as many patents upon rail joints as upon car couplers, and most of them about as impracticable. Up to the present time there has been nothing brought out which surpasses a properly designed "fish plate."

While speaking of track construction it might be well to call attention to the bonding of rails for the return circuit. Many forms are used and some of them are still in operation. I believe that a copper-bond wire long enough to connect with the web of the rail on each of the fish plate to be the best plan, and then grounding the whole system at frequent intervals, and abandon the supplementary wire which it has been the custom to use with the common form of bonding.

ELECTRIC EQUIPMENT.

Probably the greatest advance in any particular line has been in the matter of armatures for motors and dynamos. I consider that the introduction of the "iron-clad" type will do more toward reducing the bill for repairs in that direction than any other one thing that has been introduced during the year. The electric companies have all, I believe, now adopted this form as their standard, and all roads that have tried them will, I think, agree with me that for simplicity, ease of repair and ability to stand the hard usage they receive they stand at the head.

In the manner of controlling the motors most of the companies still use the time-honored rheostat, although I believe one company is endeavoring to introduce a new type of controller which they will doubtless be happy to explain at a later date.

Many roads acting under a misapprehension of the requirements, started off with motors too small for the work, and endless trouble has been the result. Some new classification should be adopted by electrical companies for designating the power of their motors, as the present "office classification" does not afford a proper understanding of its capacity, and the "horse power" term is but little better, depending on so many limiting conditions. A more satisfactory way would be to specify the number of pounds the motor can pull at different speeds, with the maximum current for which it is designed.

THE POWER STATION.

This may rightly be called the heart of an electric system. The trolley and feeder wires form the arteries, the rails and return wires the veins, and the cars the capillaries connecting them. The Biblical injunction to "guard thy heart with all diligence, for out of it are the issues of life," would certainly seem applicable to the station. The chief element to be considered should be reliability, and after that economy. Just what means shall be used to attain this end seems so far to be a disputed matter, as shown by the stations now in operation, which contain almost every conceivable device--good, bad and indifferent; all shapes, sizes and descriptions of engines, boilers and dynamos. Many designers of stations—if some of them can be said to have been designed at all—seem to have gone at their task utterly regardless of the future and oblivious to the experiences of the past. However, through it all I can say that a very marked improvement is observable lately. The designers of stations are learning wisdom from their past experiences and the makers of apparatus are more alive to the requirements of the system, and better material and workmanship can be had where required.

The recent introduction of large multipolar dynamos has brought about a change in station arrangements not heretofore obtainable, and in all large stations now being built counter-shafting is dispensed with entirely and the general tendency is toward reduction of parts, which in turn means simplicity. It is very probable that we have reached now a form of station that will be fairly permanent and the main point in the future will be the size of the units. For medium-sized stations engines with releasing valve gear bolted direct to a multipolar dynamo will be the best where the price of land is not excessive, and direct coupled engines and dynamos for larger stations. To my knowledge there have been no comparative tests made as to the economy of the various types of stations, although all reasoning would point to these latest types as being by far the most economical.

There has been heretofore too much taken for granted or assumed in electrical work, and the rapid growth of the business has called into it many who were totally unqualified for the positions which they have obtained. I attribute much of the unsatisfactory work in the past to this cause, but am happy to note that the great majority of these are passing into the background and their places are being filled with men of good judgment and mechanical resources.

TRUCKS.

The first car trucks employed in electrical work were of the pedestal form; that is the trucks were fastened to the car body and oscillated with the car. The motors, of course, had to be suspended from the car body, and the result was that the grinding of the gears was transmitted to the whole car, also the oscillation of the car body caused the motors to correspondingly rise and fall. This was very undesirable and it was soon found necessary to adopt the post form—in which the truck was complete in itself and the motors supported directly on the frame of the truck. The body was connected with the truck only by springs, thus being entirely free from the jolts and pounding of the truck.

In this form eight spiral springs were first used, the same as in the previous styles, but it was soon found that the high speed attained caused the body to oscillate to such a degree that it became very objectionable, and the different builders then modified their trucks by extending the side bars beyond the axle boxes a sufficient distance to allow an auxiliary spring to be added at each end. For this auxiliary support coil and elliptical springs have been used, both forms with marked success, and it is now possible to carry a car body twenty-eight feet over all practically without oscillation. This last modification has been a very great improvement and has settled the long car question on most street railways. I mean by this that but very few double truck cars will be used, though of course there are places where two trucks can be used to advantage, and in such places they will still be employed. But we are able to carry nearly as many people on four wheels as on eight, and to apply the power equally on each axle, so that as there is no possibility of lack of traction, there can be no gain to the railroad company in using eight wheels.

CARS.

The car bodies first employed were of the same style and proportions as those used for horse roads, and were not properly designed for electrical purposes; first the framing of the roof was too weak and would not support the trolley board properly; second, the framing of the floor was not adapted for the use to which the cars were put, for not only was the framing too weak, but it also was not well planned for putting in the trap doors which are required in order to inspect the machinery underneath the floor.

The car body which it seems to me is best adapted for the present service is one eighteen feet six inches long inside, with platforms three feet six inches long. The rafters should be strengthened with steel plates and the framing throughout should be heavier.

The coloring of cars and the necessary signs are attracting considerable attention from the different railway companies, but up to the present time I do not think any concerted action has been taken. For my part I believe that all the cars on a system should be painted the same color, that is to say, each separate line should not have a distinct color, but signs should be used to designate the different routes, preferably by means of the well-known reversible sign on the top of the car, both at the sides and front. All night the lines may be distinguished by the color of the ventilator glass, which would in each case be the same as the ground color of the reversible sign.

OVERHEAD CONSTRUCTION.

There has been a general improvement in all parts of the overhead material. We are using the stiffer poles, stronger span wires, better trolley wire insulators and handsomer curve fittings, so that the general appearance of the system is much pleasanter. The quality of insulation now in general use is far superior to what we had two years ago, and, as double insulation is now employed on the span wires, very little trouble from leakage is experienced.

The method of feeding the line is a very important matter and should receive careful attention. The best arrangement is to divide the system into several sections, so that in case of trouble along any portion of the line, such as fire, etc., that section can be cut out and the balance of the system run as usual.

A PERFECT OVERHEAD ELECTRIC CONSTRUCTION.*

BY CHARLES H. SMITH.

The president has appointed me a committee on "A Perfect Overhead Electric Construction." In thus selecting me to prepare a paper on this subject, he evidently intended to pay a passing compliment to my imaginative or inventive powers. He asks me to describe something that does not exist, something that I have never seen, although I have searched diligently for it. I can, therefore, give only my ideas of how an electric overhead line should be constructed, based upon facts and information derived from personal experience and observation.

Iron or steel poles have proved to be the most desirable. I would therefore recommend the following: the poles to be of tubular iron 32 feet in length, and made of three sections, in the usual way. The lower section should be at least 7 inches in diameter, and the other two sections 6 inches, and 5 inches, respectively. The poles should be set in concrete, and at least 6 feet in the ground, and should not be more than 125 feet apart. The top of the pole should have about 2 per cent. of rake away from the curb, and should be fitted with a suitable pole clamp, so that the span wire can be easily adjusted to the required height, which should be 22 feet above the track. On top of the pole should be a malleable iron cross arm to carry the feeder wires, and guard wire spans. This cross arm should be insulated from the pole by means of a wooden plug inserted in the top of the pole. The insertion of the joints of the pole should be at least 18 inches, and the joints should be made solid throughout their entire length by means of shims or other contrivances. If these joints are not properly made, the poles will not stand the strain. For curves or extra strain, there should be larger poles of the same make.

Span wires should be of No. 4 B. W. G. silicon bronze wire and should be fastened to pole clamps by means of insulated turn buckles. Great care should be taken in insulating these turn buckles from the poles.

All well-built lines should be sectional, and the trolley wire should not be of too great a size. I would therefore recommend No. 4 B. W. G. silicon bronze wire, which affords sufficient carrying capacity and has great strength and durability.

Sections should not be of a greater length than two miles, and should be separated by trolley breakers, of which there are now a number of good ones in the market. In cities and villages where there is great liability of fires it would be advisable to put trolley breakers at short intervals. Trolley wire hangers and pull-off brackets should be of the lightest make possible, and still have the required strength and the very best insulation. There is a variety of such hangers and brackets now in the market.

As it is important to have as small a number of joints as possible in the trolley wire, it should be put up in mile lengths, and twisted splice joints should be made and brass cone shaped slipped over the wire before the splice is made. After completing the splice, the larger ends of the tubes should be brought together over the splice and a little solder dropped through a small hole made in the tubes for that purpose, in order to keep the joint in place.

Overhead switches or switch pans, should be avoided, if possible, as they become a source of great annoyance. I would strongly recommend a double trolley wire for a single track road.

Great care should be taken in erecting the guard wire spans. They should be properly insulated from the cross arm by means of a strain insulator, or something equally as good, and should be of at least No. 6 best galvanized iron wire. There should be two guard wires over each trolley wire at least three feet apart and four feet above the trolley wire. The guard wire must be well insulated from the guard spans; in case of other wires falling, this would be of great importance. Pull-off and anchor guy wires, or other wires for the same purpose, must be of the very best material, and of at least No. 8 galvanized iron wire.

Feed in taps must not be more than five poles apart and should take the place of trolley span wire at that point. They should be of at least No. 0 insulated wire.

The trolley wire being sectional, it is necessary to run a feeder wire to each section. I would, therefore, recommend that the feeder wire be at least 30 per cent. larger than the occasion demands. It will be found that this is money well invested. The insulation on the feeder wire should be the best that can be procured, and I would advise using locust or iron pins with mica insulatiors or something equally as good, for the purpose of fastening the feeder wire to each pole, and great care must be taken to protect it from trees and other obstructions.

A cut-out box should be located on the pole at each trolley breaker, and should not carry a fuse. It should have the same wire running through it as there is on the outside. The fuses should be at the station, with ampere meter and cut-out switch for each section; then in case of trouble on any section, the location can be easily seen, and that section cut out, if necessary, until repaired.

Lightning arresters are of great importance on the line, and I would strongly recommend using them at least every thousand feet. They can easily be attached to the poles, and can be protected by means of a box.

In conclusion, I would say that no matter what expense is incurred for material, or care used in constructing, a good line cannot be insured without a thorough daily inspection.

*Report of a committee of the American Street Railway Association, read at their Cleveland meeting.

Mr. A. Carmichael and Jacob Hose have purchased the Rat Portage Electric Light, Telephone and Power Company's interests, and took possession of the property on the 1st of October.

The Toronto and Scarborough Electric Light and Power Co. has been established, and arrangements are being made to begin immediately the construction of an electric railway from the Woodbine to Little York, in East Toronto. This line is to be completed and put in operation before the end of the present year. The directors of the company are as follows: D. G. Stephenson, Reeve of East Toronto, Ald. Hallam, J. F. McLaughlin, W. T. Murray, J. J. Foy, Q.C., Robert Davies, J. P. Murray, John Stark, H. M. Pellatt and A. W. Dingman. The officers are: President, D. G. Stephenson; vice-president, Ald. Hallam.

SPARKS.

The Toronto Technical School has decided to purchase $300 worth of electrical apparatus.

Mr. G. Hazlett, recently with the Kingston Electric Light Co., has been appointed chief engineer of the Winnipeg electric light station.

Mr. Walter J. Wiggett, of the office staff of the Canadian General Electric Works at Peterboro', was married recently to Miss Gertrude May, daughter of Mr. A. Grover Heath.

It is reported that the Quebec and Levis Electric Light Co. have purchased the Montmorenci Falls, with all water power rights, buildings, etc., at the price of $235,000. The company has been paying about $5,000 per year for the power necessary to operate its circuits, and as additional power was required for this purpose, it was no doubt deemed advisable to purchase outright the whole of the available power.

The Brantford Electric Lighting and Power Co. has been organized, with a capital stock of $150,000, to acquire the interest of Mr. A. Watts, in what is known as the "Grand River level," together with the plant, buildings, etc., of the existing electric light company. It is proposed to expend the sum of $30,000 on the erection of a stone dam and other improvements. It is estimated that on the completion of these improvements, the lands will be worth $20,000 above the cost of reclaiming them, and that 300 horse power will be available.

Mr. John Patterson, of Hamilton, is the prime mover in a scheme for bringing electricity from Niagara Falls to Hamilton for power purposes, and for the operation of electric railways connecting with a number of the leading towns within a radius of 40 miles of that city. The total cost of carrying out the scheme is estimated at $2,500,000, and the city of Hamilton is asked to subscribe $400,000 of stock. Articles of incorporation are being applied for. It is proposed to erect the power house on the Canadian side of the Niagara River.

The Brush Electric Co. of Ontario, Limited, is seeking incorporation, with the object of generating and supplying current for electric lighting, heating and power in the town of Trenton, and for the manufacture and sale of electrical machinery and apparatus, and to acquire the right to furnish and operate electric railways within the province of Ontario. The headquarters of the company will be at Trenton, and the amount of its capital stock $25,000. The promoters of the enterprise are: William Scudder Rogers, Samuel Marion Hamill, John Potter, William B. Bolton, of Cleveland, Ohio; Gilbert Wellington Ostrom, William Joseph Clarke and Robert Fraser, of Trenton. William S. Rogers, Samuel M. Hamill, John Potter, Wm. B. Bolton and Gilbert W. Ostrom are to be the first directors of the company.

SPARKS.

The Victoria and Esquimault Telephone Co. are remodelling their whole system, at a cost of $15,000 to $20,000.

The Hamilton Street Railway Company paid into the city treasury the sum of $3,436 as the city's portion of profits and mileage fees for the quarter ending September 26th, an increase of $1,226 over the previous quarter.

The Hamilton, Waterdown and Guelph Electric Railway Company, Limited, with a capital stock of $500,000, is seeking incorporation from the Ontario Government. The directors are: Sir W. P. Howland, Toronto, Wm. Laking, W. Oscar Sealey, Alex. W. Brown, Jacob Flatt and Wm. D. Flatt, Hamilton, John I. Flatt, John Nicholson and Leopold Bauer, East Flamboro, and Fred. Slater, Dr. John O. McGregor and Charles Sealey, Waterdown.

IT MAY BE INTERESTING TO KNOW

That when excursion rates are made to Chicago for people who live in the East, to enable them to attend the World's Fair next year, it is contemplated by the Western roads to also make excursion rates from Chicago to all principal business and tourist points in the West, Northwest and Southwest. It may be well to consider this subject in advance of the actual time of starting, and the Chicago, Milwaukee & St Paul Railway Co. has issued maps and time tables and other instructive reading matter, which it will be glad to furnish free of expense upon application by postal card addressed to A. J. Taylor, Canadian Passenger Agent, 4 Palmer House Block, Toronto, Ont., or to GEO. H. HEAFFORD, General Passenger Agent, Chicago, Ill.