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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

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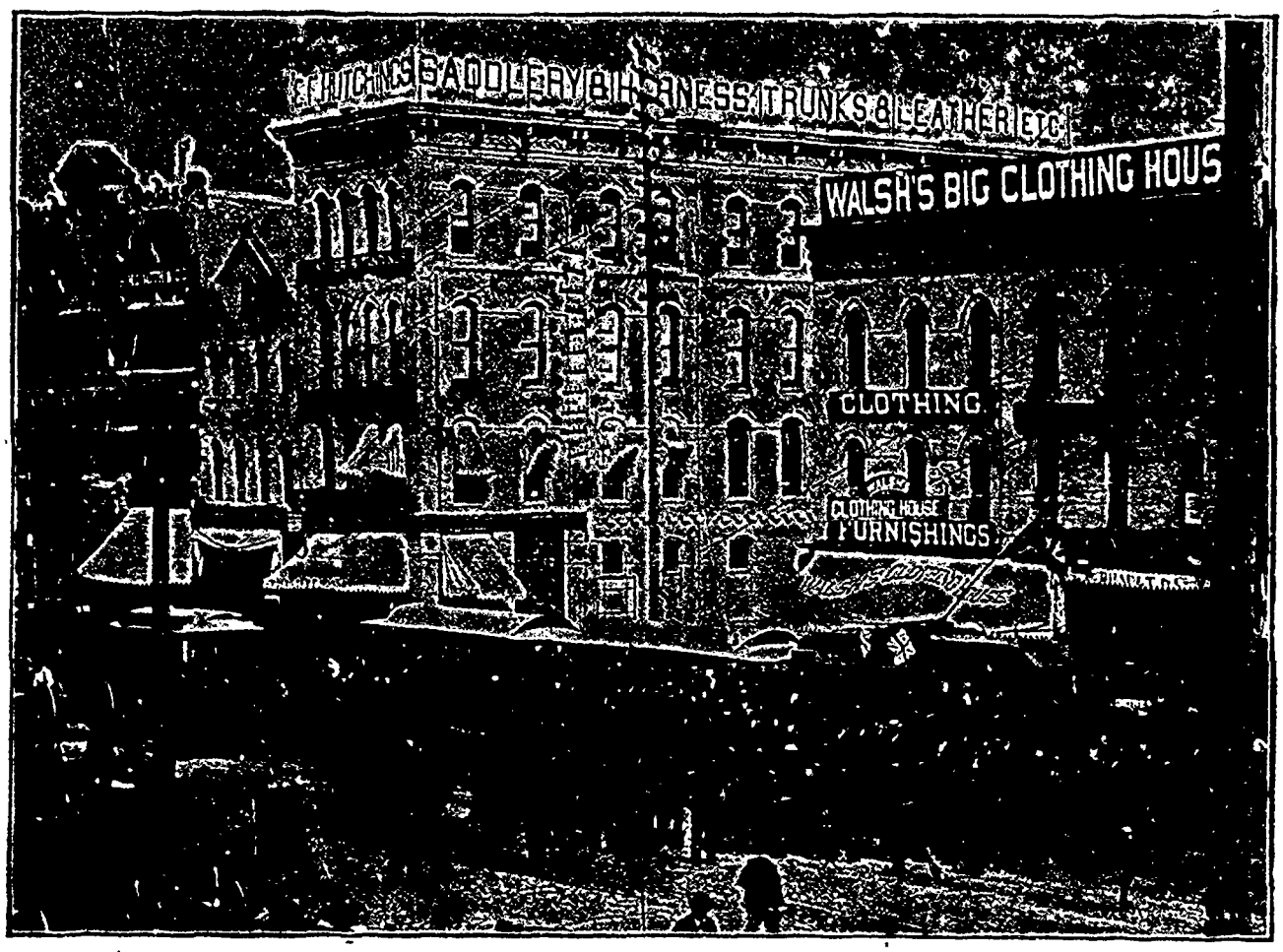
WINNIPEG ELECTRIC STREET RAILWAY.

THE accompanying illustration pictures a scene at the inauguration of the Winnipeg electric street railway.

The road was put in operation on the 5th of September last, the start being made from the city hall square at two o'clock, in the presence of thousands of citizens. An invitation had been extended by the management to the members of the Local Government, City Council, Board of Trade, and to leading citizens to enjoy the first trip over the line. On the initial trip, which was very successful, there were about 300 passengers aboard the cars.

On returning to the city hall a vote of thanks to the management for the energy shown in the construction of the road was moved by the mayor and seconded by the Secretary of the Board of Trade. The vice-president, Mr. Wm. White, and the manager, Mr. G. H. Campbell, responded for the company.

Much enthusiasm was manifested by the citizens, the completion of the road being regarded as likely to aid in no small degree the advancement of the city's welfare.



SCENE AT THE INAUGURATION OF THE WINNIPEG ELECTRIC STREET RAILWAY.

A deadlock has occurred in the Lachine Council on the question of awarding the contract for the construction of an electric railway between Lachine and Dorval. Tenders have been submitted by the Canadian General Electric Co. and by Mr. Bickerdike.

CANADIAN ELECTRICAL ASSOCIATION.

A MEETING of the Executive Committee of the Association is being held to-day (Dec. 1st) in the offices of the Bell Telephone Company, Toronto, to further the arrangements for the January convention.

Three or four papers on as many subjects of interest to members engaged in the various departments of the electrical field, are already in course of preparation, and others are being arranged for.

The School of Practical Science, in which, by the kindness of the authorities, it is proposed to hold the convention has a very fine physical laboratory, including a full equipment of electrical machines and instruments, which, with the other features of the institution, will alone afford much interest and instruction to the members.

Visits of inspection will be arranged to the Toronto Electric Light Company's central station, in process of enlargement to double its former size—and one of the largest stations on the continent—the new power house of the Toronto Street Railway Co., the Bell Telephone Company's new exchange, the Incandescent Electric Light Co.'s station, and the factories of local manufacturers. An opportunity will also be given of inspecting the Toronto Street Railway Company's system.

These visits of inspection will reveal to the observant visitor

the latest ideas in electrical devices and practice. Although prominence will not be given to the social features of the occasion, they will not be entirely overlooked.

The Committees appointed at the last convention will give a report of their work. Business relating to the progress of the Association and the annual convention of 1893 will call for consideration.

Altogether, the meeting in January promises to be one of interest, pleasure and profit, and the members are urged to assist by means of suggestions and otherwise to make it a success. Especially let every member who can possibly do so make up his mind to attend.

ORGANIZATION OF ENGINEERS AT GUELPH.

On Wednesday, November 16th, A. E. Edkins, President of the Executive Council of the Canadian Association of Stationary Engineers, went to Guelph for the purpose of organizing a branch of the Association in that town. He was met at the station by Mr. John Angell, engineer at the Ontario Agricultural College, and escorted to several places of interest around town before the time arranged for the meeting to take place, which was at 8 p.m.

Through the kindness of Messrs. W. Bell & Co., the use of their draughting room was offered as a temporary place of meeting. At the hour mentioned the following gentlemen were on hand ready to become members of the new Association :

Messrs. J Angell, P. Ryan, S. C. Cosford, C. Jorden, J. I. Dixon, L. Thompson, Jas. Fordyce, Jas. Tuck, H. Flewelling, J. Thatcher, H. Littlechilds, J. McRae, J. L. Goold, J. McNeil, E. Moodie, R. Green.

A preliminary meeting was held, at which the following officers were elected : President, J. A. Angell ; Vice-President, P. Ryan ; Conductor, S. E. Cosford ; Recording-Secretary, C. Jorden ; Financial Secretary, J. L. Dixon ; Door-keeper, L. Thompson.

Bro. Edkins was asked to explain the aims and objects of the C. A. S. E. for the benefit of a few engineers present who had no knowledge of the Association or its work. Bro. Edkins complied, and after doing so read a part of the Constitution, which apparently satisfied everyone regarding the chief objects of the Association and the work it was intended to do. All present having signified their desire to become members, the initiation ceremonies were proceeded with and the officers installed. Bro. President Angell assumed command of the new association, and in a happy speech thanked the members for the honor conferred on him, and assured them that he would with their united help strive to make Guelph No. 6 an association second to none, and one of which the members of the C. A. S. E. might be proud. General business was then disposed of.

Several committees were appointed, one of which was for the purpose of looking after a suitable meeting place. It was resolved that the association should meet on the first and third Saturday in each month, at 7.30 p.m.

Under the head of "Good of the Order," Bro. Edkins was called on by the President for an address, and spoke in substance as follows :

It is a great pleasure to me to come up to Guelph to organize you as Guelph No. 6, C. A. S. E. I have often wondered why the engineers of this city did not band themselves together as a branch of the order, but I am aware of the fact that there is a difficulty in organizing in a place of the size of Guelph that is not met with in a place like Toronto or London, owing to the small number of engineers. There are a number of places in which there are engineers who would like to organize a branch, but unfortunately there are only eight or ten engineers all told in the vicinity, and of these perhaps three or four are unwilling to join, and so for this reason in many cases associations are not formed.

These associations have been the means of doing a large amount of good in other places. By them engineers are brought together for the purpose of assisting each other, and discussing matters of every day interest. In this way each member is sure to gain some information that will help him in one way or another. We are all well aware of the fact that some men did not get the chance to acquire a good education in their youth; this certainly is their misfortune, but as a rule not their fault. An engineer may lack education, but in spite of this he may be a thoroughly practical man, and I am acquainted with many men who are in just this position.

The chief object of the C. A. S. E. is mutual improvement and instruction, and the meetings of associations have been largely devoted to this object, while we have not by any means overlooked the fraternal feature, such as helping a brother engineer in distress and endeavoring to secure employment for our members who are out of work.

I feel sure that your association here in the Royal City will prosper and be a credit to the order at large, and even though you may be small in number, if you remain true to your obligations and each one does his share of the work in and for the association, you will find that the association will prove beneficial to you all. It will bring the engineers of this neighborhood together as brothers, and be the means of creating a feeling of fraternity such as should be present among any body of men who follow the same employment to gain a living. We have the Locomotive Brotherhood, the Brotherhood of Locomotive Firemen, the Marine Engineers Association, and many others who have organized for the purpose of helping each other, and it has always been a matter of surprise to me that the stationary engineers of Canada have only made a move in this direction during the last few years.

I am glad to say that at the present time there is a strong feeling in favor of organization all over the country. The C. A. S. E. has spent a good deal of time and not a little money in trying to get an act passed in the Local Legislature for the licensing of stationary engineers. So far we have been unsuccessful in obtaining what we asked, but two years ago the Local House passed a permissive act and appointed a Board of Examiners to examine all engineers requiring certificates and to issue the same.

Up to the present time quite a number of engineers have been granted certificates, yet not as many as we could wish. We do not intend to be content with this, as we believe that what is required in Canada is a law to license stationary engineers, and thus give every steam user a guarantee that the man who applies to him for a position as engineer, has had the necessary experience and possesses the necessary qualifications to enable him to properly discharge the duties of the position to which he aspires. We do not think, or at least I do not think, it necessary that in order for a man to be a qualified stationary engineer, he must have graduated from a technical school, but I do maintain that he should at least have served a sufficient length of time in the boiler room as fireman to enable him to thoroughly understand the care of boilers and feeding apparatus, and if he has complied with this requirement he certainly should be able to pass a practical examination. If an engineer has served time in an engine or machine shop, so much the better, and you will invariably find men of this class holding the best positions all over the country and receiving good remuneration for their services.

I am not one of those who maintain that in order for a man to be a good engineer he *must* have served his apprenticeship in the shop, but what I do maintain is that if a man has served from three to five years in the shop, and in addition to this has had four or five years in the engine room, he certainly must make a good engineer. On the other hand, there are hundreds of men in the country who have worked themselves up from the boiler room by having taken an interest in their work, and while they may have but a limited education, they have the experience, and in my estimation that is what is required. It would not be right or just for any legislature to pass a law for licensing stationary engineers which would shut these men out simply because they could not pass a technical examination or explain the construction of certain parts of an engine or boiler, for there are hundreds of men in charge of stationary engines who have been at the business for years, yet if put to an examination, would fail, simply because they are not versed in the terms and technicalities of steam engineering. These same men, when anything goes wrong with their machinery, know what to do at once, and can do it quickly, but asked an hour before the accident what they would do in such a case, might not be able to answer satisfactorily.

If an act should be passed to provide for the licensing of stationary engineers, it should be similar to the one passed respecting certificates to marine engineers. When the act respecting certificates to marine engineers came into force in 1863 in England, there was a provision made granting certificates to engineers who gave proof of a certain number of years' service in the engine room, &c. These men were entitled to a certificate corresponding in grade to the position they were holding on the boat at the time the act came into operation. They had the experience, yet the authorities knew full well they could not pass the examination.

I believe the engineers on our inland waters in Canada were similarly dealt with, for I know that there are large numbers of them holding third class certificates who could not pass an examination, but who are practical men and had a certain number of years experience, on account of which certificates were granted them.

Looking at the state of affairs in regard to our marine brethren to-day, we find when they come up for examination they have to prove conclusively that they have served as engineers or firemen, as the case may be, on boats of a certain N. H. P. before the Board will examine them at all, and then the examination is severe. The coming marine engineer knows full well what will be expected of him, and consequently he adapts himself to the situation, puts in his time firing or in shop, and prepares himself for examination in his spare time. When the time comes he is ready.

As I said before, if an act is passed providing for the licensing of stationary engineers, it must necessarily, in justice to all concerned, be framed in the manner I have pointed out, and any stationary engineer who can give proof of five years service in the engine room, should be granted a third class certificate. The fatal explosions which have occurred of late prove conclusively that legislation is required to prevent steam users from placing men in charge of steam boilers who have no experience, and as a consequence know little or nothing of the duties they are expected to perform. It is the duty of every member of this association to assist in obtaining this legislation, and we should try and do everything in our power to arouse the public to demand such a law.

It is only a short time ago since I went into the boiler room of a large

manufacturing concern in Ontario and found a man filling the position of engineer who told me he knew nothing about the work. The engineer had left some time before, and he was driving the team when the boss came out and ordered him to go in and take charge of the boilers and engine. He said he knew that if he refused he would be discharged, he had a wife and family at home depending on his weekly earnings for bread. I could see the fix he would be in. He told me he knew nothing of the work he was doing, and when I asked him how often he washed out, he did not appear to understand what I meant. Is it any wonder that explosions occur when such a state of things is allowed to exist?

The law which was before the Ontario legislature three years ago would have passed had it not been for the opposition it met with from members from the saw mill districts, many of whom owned mills and were afraid they would have to pay 25 cents a day more for their engineer, and these are the very men who need licensed engineers most, judging by the number of explosions which occur in saw mills.

In conclusion, I trust that success may attend your efforts in establishing the C. A. S. E. in Guelph, and even though you may be small in number, you are banded together for a good cause, and you can rely on it that the right hand of fellowship will always be extended to you by the members of the different associations.

A vote of thanks was tendered to Bro. Edkins by the President for the address, to which he suitably replied.

Guelph No. 6 is composed of a good lot of fellows who are all practical engineers. Their officers are the right men in the right place. In fact, all the officers and members seem to have plenty of "go" in them, and Guelph No. 6 starts out with every prospect of a long and useful career.

Bro. Edkins was made an honorary member.

CARE OF STEAM BOILERS.

Editor ELECTRICAL NEWS.

LONDON, ONT., Nov. 20, 1892.

SIR,—In the November issue of the ELECTRICAL NEWS you published a paper on "Care of Steam Boilers," by Mr. Albert E. Edkins. I would like to make a few remarks on this very important subject through your columns, as I believe, as stated by Mr. Edkins, that this matter does not receive the careful consideration that it should.

With the knowledge at hand there is absolutely no reason for boilers to explode. There are reliable safety valves; there are reliable fusible plugs, and there are reliable engineers to take charge of them, and what is more, expert inspectors can be secured to inspect boilers at a very reasonable charge.

In the last 40 years the alterations made have not been very great, though they have been important. In the structure of the boiler itself the chief alterations have been in the direction of providing against expansion stresses due to the action of heat upon different portions of the boiler causing differential movements. In details, there have been improvements in the riveting and in the making of the rivet holes.

I regret to say there are still too many architects who provide the worst part of a building for the steam plant unless they are expressly enjoined otherwise. Now, right here is where the employer makes a great mistake. If, instead of an architect, he would consult some first class engineer as to where the steam plant should be put, how much room should be required for it, and how the brick work should be built, he would find that the life of the boiler would be a great deal longer, and there would be considerable saving on the coal bill.

An employer called on the writer a short time ago and wanted to know the reason why his new brick chimney would not give satisfaction. He stated that although he employed a first-class architect and bricklayers, results from the new chimney were not as good as from the old iron one in fact, the steam could not be kept up the draught was so bad.

When asked the details, he said: "The boiler is a 35 H. P., the chimney is 4 ft. square at base inside and 3½ ft. square at the top of the flue, and the height is 60 ft from surface."

Would it not have paid this man to engage a first-class engineer in the first place, in which case he would have had a first-class job, whereas as it is he knows not where the expense is going to end.

This is only one instance. A furnace under a boiler into which I looked the other day, as the fireman was shovelling in the coal, might be compared to an old street car open at both ends. Some good consulting engineer would strike quite a harvest if he could be allowed half the saving he could make in the coal bill. The so-called engineer in charge of this plant boasted to me that it was the finest bricked in boiler he ever handled. He said. "I can blow her off, wash out and fill her up again (with water at 50 F.), and then have enough heat left in the brickwork to raise steam to 10 lbs. without any fire."

Now, the city has a by-law in force, and faithfully carried out, which provides that only a small quantity of gunpowder can be kept in or around a store. My opinion is that such steam plants as the above mentioned should be classed as gunpowder in large quantities and should be taken out to some lonely spot in the country, where the "engineer" could be given a fair chance to show his abilities. Still, were such a boiler to explode, some people would think it was a pure accident.

It is high time that an engineers' license and boiler inspection law was in force and faithfully applied. I must say that much credit is due to the Boiler Inspection and Insurance Co., of Toronto, for the able manner in which their inspectors have given safety by inspection and a word or two of good advice to the engineers of this city. I know steam gauges now telling the truth, which were 5 and 10 lbs. out before inspection, and safety valves made good which were absolutely useless. In this direction we ought to set out with the conviction that a boiler is not an article to explode.

FRED. G. MITCHELL.

POWER TO RUN A DYNAMO.

By J. H. GLOVER.

ONE of the most remarkable things about the dynamo-electric machine is its power-absorbing capacity.

It is well known that in operating a mechanical device it requires less power to keep the apparatus in motion after it has been started than it does to start it. In the case of the locomotive, for instance, it requires very little steam to keep the machine in motion after it has started, but it requires great power to start it from the condition of rest. The same applies to electric cars and all other vehicles, as well as machinery. In all, the greatest power is needed to effect the start, after which little power will maintain the motion. Not so with the armature of a dynamo, however, which in its mechanical aspect is no different to any other piece of mechanism.

Naturally, the uninitiated would suppose the armature would run with great facility after it had got started, just as the locomotive does, but exactly the reverse is the case, and it is a remarkable fact that the faster the armature is revolved the greater is the power required to maintain the motion.

The armature of a gigantic 500 H. P. generator may be turned by the hand from a state of rest, so delicately is it balanced, but to run it at a speed of several hundred revolutions a minute requires the energy of a steam engine of great power, and within certain limits the faster we run the armature the more steam power will be required.

Now, what is the reason for this apparent anomaly in mechanics? It is this. When the armature is at rest there exists no magnetic field, the existence of which depends upon the motion of the armature, and the faster we run the armature the denser will the magnetic field become. The elements of the magnetic field consist of what are ordinarily termed "lines of force," and when we speak of a dense magnetic field, it is another way of saying that there are a great number of "lines of force." One of the peculiar properties of the magnetic "lines of force" is that they tend to arrest motion, and in the case of the dynamo the tendency always is to stop the motion of the armature in its revolutions. It is evident, therefore, that the stronger the magnetic field, and consequently the greater number of "lines of force," the greater will be the tendency to arrest motion, hence the greater will be the power necessary to overcome the retarding influence of the field.—*Electrical Age.*

Mr. W. A. Grant, formerly secretary to Mr. Van Horne, President of the C. P. R., has been appointed manager of the Niagara Falls Electric Railway, and will enter upon his duties at once. The railway, however, will not go into operation until the spring.

The Back River Power Co., Ltd., is applying for incorporation at Montreal. Its capital stock is to be $200,000. The applicants are.—John Thomas Wilson, merchant, James Robert Walker, merchant, Gilman Cheney, gentleman; Evans Fisher Ames, manufacturer, and Frederick Milton Cole, insurance agent. The object of the company is to lease or sell water power or electric power to individuals, companies or municipal corporations.

C. A. S. E. BANQUET.

The Sixth Annual Dinner of the Canadian Association of Stationary Engineers was held on the evening of the 9th of November, at the Richardson House, Toronto. About 70 ladies and gentlemen sat down to dinner, amongst whom were noticed the following :

Guests Messrs. Geo. Grant, Jas. Watson, Wm. Towers, J. Wright, W. S Brown. Prof. Galbraith, J. Main, R. Hutt.

Lady Guests Mrs. R. Hutt, Mrs. Wm. Towers, Misses A. M. Wickens, E. M. Wickens, Miss Mortimer, Misses M. Croacke, M Coutts, I. Coutts, J. Winters, L. Kennedy, Miss Winters, L. Smith.

Members and wives Mr. and Mrs. F. G. Bain, Wm. Butler, W. G. Blackgrove (President), Mr. and Mrs. H. Caldwell, A. E. Edkins, Geo. Emory, J. Fox, Geo. Gilchrist, Mr. and Mrs. Chas. Heal, D. Jeffrey, Mr. and Mrs. Chas. Kinsey, W. Lewis, P. Myers, Mr. and Mrs. Chas. Moseley, J. C. Mooring, W. Phillip (V. President) and Mrs. Phillip, E. J. Phillip (Sec'y), William Reveley, T. Rolph, C. Scott, W. Sutton, Mr. and Mrs. George Saunders, E. Tipton, H. Terry, Mr. and Mrs. A. M. Wickens, Jas. Wadge, H. Winters.

An excellent bill of fare was presented, and after full justice had been done thereto, the "Queen" was proposed and drank in royal style. The "C. A. S. E." was coupled with the names of Bros. A. M. Wickens and A. E. Edkins, President of the Executive Committee.

"Our Manufacturing Interests" was coupled with the names of Mr. Brown, of the Globie & McCulloch Co., Galt, and Mr. J. W. Main, of John Inglis & Sons, Toronto.

Mr. Brown, in responding referred to the growing influence of the C. A. S. E., and the many benefits that had been derived by its members. The Association was not only beneficial to members, but also to employers, as it enabled them to secure thoroughly capable men. The engines were better taken care of and better satisfaction given in every way.

Mr. Mrain also spoke, expressing the pleasure it afforded him to be present. He had attended several dinners of the Association and always enjoyed himself. He was pleased to see the Association prospering, and hoped that it would continue to advance in the future as in the past.

"Our Educational Interests" brought forth a response from Prof. Galbraith, who said :—"It is with peculiar feelings that I arise to respond to this toast to-night. I think I have been at every annual dinner that you have held since the beginning, and I must say that I never felt so embarrassed as to-night. I think the last time that I had to make a speech in the presence of ladies, that is aside from a written speech or something of that kind, was the morning that I was married, and I observed the five minute rule then I can assure you. I didn't attempt to fill up the time. But, ladies and gentlemen, I think that we must all acknowledge the advance of the times; ten years ago we never thought of seeing a lady at our classes in the University; to-day we think nothing of it. (Laughter). The professors are quite accustomed to speaking to ladies; it is only within the last year that we had the pleasure of addressing any ladies. There is one now attending the School of Science—the first one. I am beginning to get accustomed to it, but it takes a great deal of courage I am sure. But this has quite driven the subject of the toast out of my head. As a change has taken place in the respect that I have just mentioned, so changes have taken place in educational interests with which we are concerned, namely, in technical education. It is only, I think, four years ago since we had nothing but bare drawing tables, seats and blackboards, and a few books. Now we are pretty well fitted out with a large quantity of apparatus and machinery. Within the same period the technical evening school has become a fact. Four years ago your former President, Mr. Wickens, and your present President were working hard with us to get that school established, and we never expected to meet with the success that we have. For the first year we worked in the same way as we have worked for a long time in the School of Science, with very little except mechanical apparatus. This year I am glad to say that the council have given a fairly large grant toward electrical apparatus, and I am glad to say that as time goes on we shall find both of these classes—the School of Science and the Technical School—growing and increasing. I don't fear now that they will fail; a few years ago we scarcely hoped that they would succeed. I scarcely know what I can say more than I have said on former occasions. One thing perhaps I may say: I promised you for the last three or four years an evening at the School of Science. I promised it so often that I felt sure that you had lost all faith in my promises. However, I determined to be at the dinner to-night and speak a few words to you, and now I think I can take courage and make a further promise, sometime during the coming winter to give you a more extended address something that will interest you. I am glad to see your society progressing as it is, and from the signs that we see at the end of the table, I am glad to believe that it will never die out.

The Host and Hostess were then proposed, to which Mr. Richardson responded.

After the room had been cleared, the following programme, interspersed with dancing, was gone through :—

Piano solo, Miss Croake; song (comic), Mr. F. Wright; duett, G. W. Grant and Miss Mortimer; song, Mrs. Bain; song, Mr. Major; duett, G. W. Grant and Mr. Blackgrove; song, Mr. F. Wright; song, Miss Mortimer; duett, G. W. Grant and and Mrs. Bain; song, Mr. Major; song, Mr. F. Wright; Miss Croake, pianist.

AN AUTOMATIC TELEPHONE.

The Automatic Telephone and Electric Co. of Canada has been organized at Montreal, to introduce an instrument designed to enable each subscriber to a telephone exchange to make his connections without the assistance of a third person at the exchange. Mr. James P. Dawes is the President of the new Company, and Mr. H. M. Linnell, formerly manager for the Edison Co., is to be the managing director. Among the directors are Messrs. John Torrance, R. Wilson Smith, L. M. Dupnis, J. B. Clarkson, J. E. Macdougall, and Alf. Lomas.

The invention, which is said to have been proved by tests to work with entire satisfaction, is thus described by a local paper: It is a device to automatically make the connections in a central exchange and dispense entirely with the services of an ploye at that place. The method by which this is accomplished is simple. On the telephone shelf is a row of keys, five in all, marked thousands, hundreds, tens and units, the fifth being a release key. The subscriber who wishes to place himself in communication with some one of the other hundred or thousand subscribers taps out the desired number on the key-board, which automatically connects his wire with that of the person with whom he wishes to speak. Suppose for instance, that a subscriber wishes to communicate with No. 1123. He simply presses the key marked thousands once, the key marked hundreds once, the key marked tens twice, and finally the key marked units three times. His wire is then in electrical connection with that of the subscriber 1123, and he can ring his bell and converse with him in the same way and with us much ease if he had been wrangling with central for five or ten minutes. The whole mechanism of this, the Strowger, patent takes up a space of only 6x4x4 inches. The apparatus is placed in the central exchange and takes the place of the ordinary telephone girl. As for the subscriber's end of the line, there is nothing more than the ordinary telephone with a row of keys upon its shelf; the mechanism at the exchange consists chiefly of a circular disc constructed of hard rubber or any other suitable non-conducting material, and this is the central feature of the machine. This disc is provided with perforations in circular rows of 100 each, these rows being about one-twentieth of an inch apart. Through these perforations extend the wire connections to the main line wires, so that the wire of every subscriber in the exchange comes to this instrument, and passes up through one of the perforations, ending in a good metallic contact slightly raised above the face of the disc. If, now, a moving arm or needle can automatically be made to make contact with any one of these points at will, it is evident that a telephone circuit can be completed and the object of the invention attained.

This is accomplished in the following manner :—A circuit-closing arm is made in parts, of which one is a rod. Within the circuit-closing sleeve is closely fitted a circuit-closing needle held in such a manner as to be in perfect electrical contact with the wire terminal by a spring. A rod is located along the axis of the cylinder and is free to rotate and move longitudinally;

the lower end of this rod is sleeve
upper portion of the rachet rod. Th
the racthet rod to have a longitudinal
ing the ratchet teeth continuously tow
The rachet rod is provided outside of the
iently below it with a series of ratchet teet
the rods are moved longitudinally. Two whe
the rods extend with a feather and groove conne
in contact with the ratchet teeth and levers, having
in their ends. Each lever has a vibratory moveme
oscillated by the alternate energizing and de-energiz
electro-magnet, thereby imparting motion to its adjacent
teeth, and consequently the circuit closing needle. Each pressure of the push button at the exchange made at the will of the operator, causes, through the channels thus described, the circuit closing needle to move from row to row and from wire to wire, it being understood that both ends of the wire are grounded or connected with a return tap, and also that a battery is used to generate the current. This battery is located at the sub-station between the keys and the ground.

Each perforation of the cylinder is numbered with respect to an initial or starting point on the cylinder. When any conversation is ended the person hangs up his ear phone and presses the release key. This causes the magnets to be energized, attracting the armatures, thereby withdrawing the several pawls from their engagement with the ratchet teeth and allowing the circuit closer to fall and return to its initial point.

The subscriber is never isolated from the exchange. Suppose that two persons are in communication with each other and a third wishes to speak with the first. He can tap the number and make sufficient connection to ring his bell and call his attention to the fact that some one wishes to speak to him, so that the first subscriber can then at will release his instrument from the one with which he is in connection and connect with the third man, or he can continue his own conversation until finished, when upon pressing the release key, he will find himself in communication with the third person. The outside party, however, cannot either speak with the other party or listen to any of the conversation, he can only obtain sufficient connection to ring his bell.

Mr. Linnell claims that there can be no errors in the call, for an arrangement is provided on the instrument of every subscriber so that the number which he calls up is automatically registered on the front of his telephone. If a subscriber calls up No. 100 he sees 100 in plain figures on the face of his instrument, and there can be no question as to whether he is in connection with the right person.

A FEW POINTS ON UNPACKING AND ERECTING.

In unpacking machines and lamps, be very careful, says the *Scientific Machinist*, that packages are never dropped or jarred in any way.

Use special care to avoid dropping anything on to the lamp rods or arc lamps.

Never lay an arc lamp on its side, but set it up in some secure place.

After taking lamps out of boxes, remove the packing blocks, and see that all parts are in proper position and working freely.

In unboxing the dynamo, do not attempt to remove it from the box after simply taking off the cover; but, instead, knock the entire box apart, leaving the machine standing on the bottom piece only. If the armature is shipped in a separate box from the balance of the machine, it will, in most cases, be necessary to use a hoist for the purpose of placing it in position, and great care should be used to avoid scraping or cutting of the shaft wires, or armature bobbins, in dropping the armature into place. Look the machine over thoroughly, and see that everything is in place and all screws tight. Secure the pulley firmly on the shaft.

It is a good plan to run a dynamo idle for a day, or even longer, if possible, following this with several hours' run with only a light load. This load should only be sufficiently heavy to warm up the fields and armature, so as to dry them out thoroughly in case they have become damp during transportation. A little care of this kind before putting the machine into regular service, will avoid trouble at a later stage of the proceedings.

It is very important to locate the machine in a dry place, and

[redacted] operating
[redacted] of lighting machines, it may not be necessary to run all of the dynamos for exactly the same length of time. Under such circumstances, a clutch pulley must be provided on the main shaft, which will permit throwing on or off the dynamo which it drives, as such dynamo may be needed or dispensed with.

A light double belt is the most desirable for lighting work. It should never be less than 30 feet long, and should be very pliable. If the belt is new and stiff, it can be softened up by applying neat's foot oil, or belt oil, on the outside.

THE MONTREAL LIGHTING CONTRACT.

Following are the terms upon which a committee of the Montreal City Council has recommended the renewal of the city lighting contract with the Royal Electric Co.: "That the contract for lighting the city of Montreal by electricity be awarded to the Royal Electric Company for a period of ten years from the first of January, 1894, at the following prices. For the first five years at 34 cents per lamp per night, equal to $124 per year; for the following three years at 33 cents per lamp per night, equal to $120 per year; for the remainder of the term, two years, at 32 cents per lamp per night, equal to $116 per year; each lamp to be of 2,000 nominal candle power." The present contract is $146 per light, and has one more year to run, but in consideration of a renewal the company agrees to reduce the price for the remaining year to $124 or a total of about $22,000, which would make an average of $110.35 per light for the whole term. The company under its present charter has an absolute right to maintain its poles in the streets, but it makes the following concessions: "Should the city at any time during the continuance of the present contract construct conduits for the placing underground of all electrical wires for whatever purposes they may be used, and cause all such electrical wires to be placed in said conduits, the Royal Electric Company shall make use of such conduits for its wires on such terms as may be mutually agreed upon, provided, however, the expense to the company for supplying electric light to the city or to its inhabitants be not thereby made more onerous than if they were to continue to use poles for the purpose; and the company will then remove their poles from the streets, wherein such conduits are constructed without indemnity."

The following are the officers of the Canadian General Electric Co.:—President, W. R. Brock, first vice-president, H. P. Dwight; second vice-president and general manager, Frederic Nicholls; assistant general manager, M. D. Barr; comptroller, Walter S. Andrews; chief engineer, W. M. Rutherford; assistant engineer, H. T. Hartman; purchasing agent, Geo. W. Watts; superintendent Peterboro factory, William S. Andrews; superintendent Hamilton factory, C. S. Stilwell.

I have an idea which, though not new to some, may be of use to others. It is just a little wrinkle in babbitting a journal box. When lining up a shaft, put a small piece of pine wood in the bottom of the box, in length about 1½ or 2 inches less than that of the box, and in width ¼ to ½ inches, according to the size of the box. Equalize it in the bottom from each end, 'et the shaft lie on it, and pour. After you have scraped out the box, remove the piece of pine and substitute some woollen cloth saturated with oil. This prevents the oil from dripping, and not only insures a more positive lubrication of the journal, but also is clean and requires less oil than other journals. No patent is infringed.

A coating of pulverized chalk is excellent for preventing the packing sticking. A paste of graphite, plumbago, or black lead, as it is variously called, is most excellent. It is the finely pulverized product that is used, and the paste is made with water or some oil, having no gum as kerosene or lard oil or glycerine. Some old-time boilers used to have a steam dome surrounded by a cast iron safety-valve, from which steam is led to the engine. The valve is usually, in such cases, fastened to the dome with cap screws, holes for the same being drilled therein and tapped—the flange of the valve and dome being made steam tight by a rubber gasket between. If the rubber is objectionable, and the iron is wanted to join, a rough joint may be made tight and durable by putting between a cement made of boiled linseed oil with two parts litharge and one part each of fine sand and air-slacked lime mixed to a paste. It dries rapidly and should be screwed down before too stiff. This cement is equally applicable to joints below the water line.

OFFICE: CONFEDERATION LIFE BUILDING,
Corner Yonge and Richmond Streets,
TORONTO, - - CANADA.
64 TEMPLE BUILDING, MONTREAL.

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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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GUELPH BRANCH NO. 6.—Meets every 1st and 3rd Saturday at 7:30 p.m. J. A. Angell, President; C. Jorden, Secretary.

...t the Toronto waterworks had a ...ays ago. A steel crank pin broke ...rough the back end of the large steam ... the daily papers it was estimated that ...00,000 lbs. to the square inch on the piston ... The pressure was certainly more than the ..., but if there had been even the half of the al... there would not have been much of the engine ... in which broke was five inches in diameter and the ... presented a rather brittle appearance.

...ERY strong protest is being made by electrical manufacturers and the electrical journals of the United States against the rule adopted by the Commissioners of the World's Fair to *close the gates at 7 p.m. The Commissioners have explained* that the rule was adopted not with the purpose that it should be enforced every evening, but to place in the hands of the Commissioners the power to regulate the hours of closing. This does not satisfy the electrical people who have gone to great expense in preparing exhibits in the belief that the Fair would be open every evening. It is probable that the protestations will be so vigorous as to compel the Commissioners to alter their decision.

THE Montreal City Council is considering the question of the renewal of the lighting franchise, and has appointed a committee to confer with the Royal Electric Light Co. on the subject. This action on the part of the Council has aroused the criticism of the citizens, on the ground that a clause in the present contract provides that the contract shall not be renewed, except after tenders have been called for at least one year before its expiry. There are several other companies desirous of tendering for the franchise, and they are talking of applying for an injunction to restrain the Council from renewing the contract with the Royal Co. without publicly inviting tenders for the same. There is every indication that proceedings of a lively character will precede the settlement of the matter. Since the above was written, the Committee has recommended to the Council a basis of renewal with the Royal Electric Company.

A HIGH spirited electric car in Montreal resolved the other day to get out of the rut. It consequently forsook the rails and made a bee-line for the sidewalk. A lady sitting in an upper window saw it coming and promptly went into hysterics. Fortunately for everybody concerned, the runaway didn't succeed in dodging an electric light pole that stood in its way. The pole was snapped off as though it had been a twig, and the force of the concussion landed the motorman and one of the company's experts over the dashboard. The car was but little injured. Although to all appearances it has become resigned to again pursue the even tenor of its way, a watch should be kept on its movements, as, like a horse who has once felt the pleasure of getting free from control, it is likely some day to want to repeat the experience.

THE chief engineer at the Badger Electric Light Co.'s works, Milwaukee, was killed a few days ago. It appears he was alone in the engine room when the steam pipe burst and he died from the effects of scalding. He had the steam shut off and was repairing the engine, at about half-past four in the afternoon. Some other employee turned the steam on, with the result that the pipe burst and the chief lost his life. Leaky valves and thoughtlessness are responsible for the greater number of such accidents as this. A leaky valve when shut allows a little steam to pass; this condenses and water accumulates in the pipe beyond the valve. A thoughtless attendant will open the steam valve without first draining off the water, or he will open it up quickly instead of slowly, and the sudden rush of high pressure steam into the pipe and coming in contact with the water will produce water hammering enough to rupture the strongest pipe.

CHIMNEY draught when defective has been helped in many ways—sometimes by a fan forcing air under the grates, or by a steam blast forcing air under the grate or over the fire. In locomotives the draught is induced by exhaust steam forced through a jet at base of the smoke pipe. Korting Bros. make an apparatus which is placed in bottom of chimney and by means of a straight jet induces a current of air. A Chicago firm is at pres-

ent trying the experiment of an exhaust fan placed on top of the chimney. If it will work at the top of the chimney, why not have it at the bottom, and save the trouble of carrying the power up so high and having to send oil up to the bearings? The chief difficulties in using an exhaust fan for promotion of a draught are the high temperature of the gases passing through the fan and the necessity for getting rid of the gases. If the fan could be got to run notwithstanding the high temperature of its bearings it might be a good plan to make the discharge go down into the sewers. Enough deadly gas might be sent down and hot enough to kill all the typhoid fever and diphtheria that are said to dwell in the sewer.

As we were going to press with our last issue we were the recipients of a letter from the Brantford Electric Light Company complaining of an editorial in a previous issue of the NEWS commenting on the low prices, etc., obtained in a near-by city on the renewal of their electric lighting contract. As we did not mention any names in connection with the article complained of nor indulge in any personalities whatever, we must decline entering any further into the matter, further than to say that we had no wish to tread on anybody's toes, but only to point out to our readers the necessity of using their utmost endeavors at all times to give their patrons the best of service, and thereby secure at least fair prices for that which they have for sale.

THE Council of Toronto Junction, having had enough experience with municipal electric lighting, have sold their plant, together with a nineteen years' franchise, to the Toronto Incandescent Electric Light Co. for the sum of $26,900, on condition that the purchasers will operate the plant in Toronto Junction during the term of the franchise. The City Council of London, Ont., seeming to be influenced by the experience of a smaller town, is about to insist upon the privilege of purchasing in the dearest market a stock of experience of its own. A by-law will therefore be submitted for the approval of the ratepayers to authorize the appropriation of $60,000 for the purchase of an electric light plant. Possibly, as in the case of Brantford, the citizens will knock the scheme in the head. There is likewise the possibility, if not the probability, that this announced intention of the Council is simply designed to be used as a lever with which to bring pressure to bear to induce the Company, which is at present furnishing light to the city to lower its prices. In any case, we hope to see the scheme fail.

THE cold weather compels attention to the heating apparatus. Now the landlord complains of the large amount of coal required at the boiler, while the tenants complain of the small amount of heat at the radiator. The best designed and most perfectly constructed apparatus will not heat the building unless it be attended to. Coal is put in the furnace to be burned, but when it is put on top of the bridge wall or on the dead plate just inside the furnace door its burning will not do much good. The making of fire under a steam heating boiler requires experience and skill. The method of employing the man who will shovel the most coal for the least money is a mistaken one. It gives satisfaction to none of those concerned, unless the coal dealer. It will pay owners of steam heating plants to employ competent men and pay them according to results. As a rule it will be found cheaper to keep a large building warm all night as well as all day, than to let it cool down at night, and a skillful fireman can arrange his fire so that for six or eight hours after he has left it the boiler will still make vapor enough to keep the radiator warm.

THIS is the agreement which the city of Kingston requires any company to sign in return for the privilege of supplying an electric street car service:—"The company to pay to the city annually the sum of $200 per mile for single track and $300 per mile for double track, for rent and keeping roadbed in repair, also the following percentages on gross receipts, viz.: When the total gross receipts reach $15,000 per annum three per cent. on the total gross receipts till they reach $20,000 per annum, and when they reach $20,000 per annum four per cent. on the total gross receipts till they reach $30,000 per annum, and when they reach $30,000 per annum and upwards, six per cent. on the total gross receipts." An alderman after a perusal of these conditions is said to have remarked that no one outside an asylum could be found willing to make an offer on such a basis The present street car company claim to have the right under their charter to a perpetual use of the streets and refuse to change to electricity unless this right is recognized. On the other hand the city authorities contend that the law provides that a charter for electric street cars cannot extend beyond twenty years unless special legislation is obtained, in which case the period may be extended for another ten years only. No doubt a demand on the part of the citizens to be given the advantages of electric transit will before long force a settlement of the existing difficulties.

THE novel sight of a brigade of axe men engaged in chopping down poles erected by the Street Railway Company has lately been witnessed on the streets of Toronto. The City Engineer's action in ordering this to be done seems justifiable. The agreement which the Street Railway Company entered into with the city provides that the character of the construction and equipment of the system shall be subject to the approval of the City Engineer. The Company has lately acted as though its intention was to evade as far as possible compliance with this agreement. It has erected poles which would disgrace the streets of a backwoods village, and has accentuated their native ugliness by painting them a variety of colors. In many cases a brilliant red is the prevailing hue. Is it a matter of any wonder that the citizens of so respectable a city should object to the Company "painting the town red"? There seems to be manifest in the Company's dealings with the city as well as with private corporations and individuals a disregard for the rights of others as well as its own promises. To get possession of what it wants now under promise of remedying in the future what is below the standard, seems to be the policy pursued. Whatever the other party to the contract may do, the Company appears to have always in mind the fact that "possession is nine points of the law." If the company intends to continue to own and operate the road, it is making a huge mistake by antagonizing public favor, and even if, as is asserted, its intention is to dispose of the franchise, the fact of its being at loggerheads with everybody must tend to lower the value of the privilege in the eyes of intending purchasers. We refer to this matter because such conduct is calculated to increase the prejudice against which promoters of electric railways have had to contend, and thus to retard further development.

ONE important point in the operation of incandescent electric light from a central station, and which is a vital one when the cost of operating is taken into consideration, is that due care and diligence should be exercised at all times to see that the lamps on the circuit are never allowed to be strained with higher voltage than they are made to carry. We feel sure that we are right when we make the assertion that an increase of 5 per cent. in the voltage maintained for say 100 hours in the life of a lamp will shorten its life fully 25 per cent., which means that the lamp account is 25 per cent. more than it would have been had the lights been kept at or below their normal voltage. We are aware that it is sometimes a difficult matter to so arrange things that this can be done, but there can be no question that it will pay well to see that it is so arranged. This is a matter that is perhaps more difficult to adjust on alternating methods of supply than on straight current machines, as they are generally compound wound, and take care of variations in load with only an occasional hand adjustment, which is necessary almost continually in the general run of alternating dynamos at present in use in this country, while the load is fluctuating either in one or the other direction. There are alternating dynamos being manufactured for which the claim is made that they are self regulators in every sense of the word, but their use in Canada has been very limited owing to the fact that it was necessary to import them and pay heavy duties, bringing the price to such a pitch that it almost prohibited their use here. In this connection we are credibly informed that this state of affairs is about ended, and that at least two of the large manufacturing electrical companies in the Dominion are at present getting out plans and patterns for self-regulating alternating dynamos with compound windings, in the use of which potential wires and compensating devices will be things of the past.

THE ELECTRICAL NEWS completes with this number its second year of existence. An index to the contents of this volume accompanies the present number. A perusal of it should satisfy every subscriber that he has had value for the price of subscription. Indeed, some of our most intelligent subscribers have expressed the opinion that in some cases a single article was in itself worth to them the price of a year's subscription. The co-operation of every reader is asked towards making the paper increasingly valuable, and thanks are extended to those who have in any way assisted its progress in the past. To all the wish is extended for a Merry Christmas and prosperous New Year.

IT isn't often of late that the tallow dip and coal oil lamp get a chance to demonstrate their usefulness in competition with the incandescent electric light. Such an opportunity came to them, however, in Toronto a few nights ago, when by reason of the fusing of a safety catch in the junction box of an underground feeder, the incandescent lamps went out. In many of the business buildings gas has been entirely dispensed with, and when darkness settled down upon them, the lighting methods of our ancestors suddenly regained a brief popularity, while at the same time serving to impress the public mind with a greater appreciation of the value of the modern illuminant.

IN supplying power from a central station for the operation of a number of small motors, it is of the utmost importance to both those supplied as well as to those supplying it, that a constant pressure or E. M. F. be maintained on the mains during all the time that it is in operation. A greater fluctuation than 5 per cent. should under no circumstances be allowed by the attendant in charge of the generating plant. The principal reason is that a motor running at or about full load at a certain speed will feel a greater drop than this very sensibly, and will lose a number of its revolutions, particularly if the drop is as great as 10 per cent. So great would be the difference in the number of revolutions, particularly on very fast running small motors, that it would cause an appreciable difference in the amount of work being turned out by the various machines under operation, meaning of course a loss to the power customer, which if kept up for any length of time, would in all probability cause him to condemn electric power or perhaps throw it out entirely. True, the fluctuations in load on a generator, that, among other things is operating a few passenger elevators, is sometimes so great that it precludes anything like fine governing either by hand or automatically, but the fact remains nevertheless that it will pay best to keep up as near a constant pressure as possible. These remarks do not apply to generators operating street railways, for in their case there is so great a fluctuation in the load at times as to make it almost an impossibility to maintain a constant and steady E. M. F., nor is it essentially necessary to do so, owing to the fact that a regular speed is not required, it being seldom necessary for the motor man to turn out all of the resistance of the rheostat to get his car to travel its set speed, and a drop in the E. M. F. can easily be compensated for by turning in a little more current, it being a combination of the E. M. F. and amperes (or watts) that does the work.

WE have quite recently seen tested a one inch by half inch oval carbon for all night single rod lamps, and to judge from this test, they are unquestionably the right thing in the right place. The test on a 10 ampere current showed a life of 10 to 20 hours for each pair (one twelve and one seven inch), plain black ones being used, without any coating of copper at that. In fact a test was also made at the same time of a coppered one of the same size, but owing to the carbon being consumed without breaking down or fusing the copper, it was necessary to occasionally knock off the long metal horns which formed at the extreme outside width of the carbon. In using this style of carbon it is necessary in order to obtain the best results, to set them in the lamp at right angles to one another, and also that means be provided in the lamp to keep them in this position as they feed down. This is not an easy matter to do in the ordinary clutch lamp, perhaps, but in a clockwork lamp, with rack rods, no other device is necessary than to fit them with holders suitable to the shape of the carbons. Such carbons are actually money savers to the company using them, their first cost being considerably less than would be that of enough 7/16 carbons to last the same length of time. Again, there is this consideration, that a plant requiring the lamps trimmed every day, say for six months in the year, would only need them trimmed or carboned every other day for the other six months. Thus, one trimmer would take the place of two for that length of time, a decided saving as all will admit who have weekly wages to pay to half a dozen or more trimmers, and who find it uphill work to make the plant even show a semblance of paying any profit to those who have their money invested in it. The argument may be used that it is necessary that every lamp should be looked after in some way or other every day, to see that the rods are clean, etc., but this is not absolutely necessary where a black carbon is used; they cannot pass by or become locked if used as shown above, nor can there be any reason whatever advanced to show that this method of all night lighting is not a change in the right direction and a money saver for the company. Another point, is that the dynamo may flash around the commutator without the least fear that there will be any of the carbons pass by or lock, which is decidedly not the case where a double rod lamp and 7/16 carbons are used.

C. A. S. E. No. 6, GUELPH.

GUELPH, NOV. 21, 1892.

Editor ELECTRICAL NEWS.

A regular meeting of No. 6, C. A. S. E., recently organized here, was held on Saturday evening last. Two applications for membership were received. Every member was present, making the total attendance 16.

The President, Mr. John A. Angell, gave a lengthy and practical lecture relating to boilers, the common slide valve engine, steam pumps, etc., and questioned the brethren on these and other subjects pertaining to steam engineering.

So pleased was everyone present with the lecture, that a resolution was passed requesting the President to repeat it at next meeting.

As we are but new beginners, we would feel greatly obliged for any information or assistance of any kind which our more experienced brethren in the Association may feel disposed to give us.

Yours truly,

C. J. JORDAN, Rec. Sec.

PERSONALS.

We have been favored with a copy of a Newport paper containing full particulars of the wedding of Mr. John Carroll of the Eugene Phillips Electrical Works, Montreal, and Miss Emily Selina Ryan, of Newport. Miss Sadie Carry was the maid of honor, and Mr. Andrew J. Carroll the best man. The ushers were Messrs. Sanford Gladding, Dr. Wm. Carry, Wm. Christie, of Montreal, A. J. Carroll and H. T. Rooney. The residence of the bride's mother, where the ceremony and wedding festivities took place, was tastefully decorated for the occasion. A large number of the friends of the contracting parties were present. Mr. and Mrs. Carroll left Newport the same evening for New York, and returned a few days ago, by way of Toronto, to their future home in Montreal.

In a recently published list of men of wealth in Montreal appears the name of Mr Charles R Hosmer, director of the C. P. R. telegraph system. The following particulars of Mr Hosmer's career, from the Kingston *Whig*, will be of interest to our readers:—"He was an operator in the service of the Montreal Telegraph company when the Dominion Telegraph company was projected, and he had the ambition to advance and become manager. The new business prospered under him, and it was not long ere he was translated to a higher sphere, to the position of superintendent of a division, in which he showed much ability and qualified for the responsibilities of a still higher position that which he holds now as director of the Canadian Pacific railway's telegraph system. He is one of the best known telegraph men in America and in connection with the Commercial cable he is known across the Atlantic also. It may be said that for him there were grand openings presented to but few, but how many are there who do not take advantage of the opportunities they have had and so give point to the old law that 'nothing venture nothing have?' Granted that Mr. Hosmer was fortunate in his associations, fortunate in his choice of situation and lucky in his chances, he had the tact and the wisdom to carry himself right, and he shaped his purposes and plans to suit the emergencies of life. Above all he has not lost his head; success and prosperity have not interfered with his usefulness, and he is as active and enterprising to-day as when he set out, only a few years ago, to build up a name and a reputation of which he has reason to be proud. His record should be an inspiration to all young men. It points to what can be done by work and courage and laudable ambition."

Some of the officials of the city of Toronto profess to have discovered that the Toronto Electric Light Co.'s building stands partially on the line of a public street. The company deny that such is the case.

SPARKS.

The Council of the town of Port Hope has appointed a committee to ascertain the cost of an electric light plant.

An electric tramway, to connect the town of Rat Portage with the towns of Norman and Keewatin, is projected and will probably be built next summer.

It is stated that the construction of an electric street railway in Halifax has been definitely decided upon, and that the work will commence in the spring.

Mr. J. Culverwell, lately representing the Edison General Electric Co. at Montreal, has been appointed general agent of the Automatic Telephone Co. of Canada.

The experiment is to be tried at Ottawa, of drying lumber by means of electricity. The apparatus for that purpose is in course of construction by Mr. Parr, of that city.

Mr. Maxwell, of the Portland office of the General Electric Co. has been appointed as manager of the British Columbia division, to succeed Mr. J. S. Anderson, resigned.

A resolution was recently passed by the Board of Works of the City of Hamilton, requiring the Hamilton Electric Light and Power Co. to verify by declaration all their accounts.

A by-law authorizing the issue of debentures to the amount of $14,000 for the purchase of an electric light plant, was carried on October 24th, by vote of the ratepayers of the town of Niagara, Ont.

A company recently organized has applied to the Council of the city of Quebec for permission to build an elevated electric street railway in that city. They also ask exemption from taxation for 30 years.

Stock to the amount of $60,000 has been subscribed for the purpose of constructing an electric railway to connect the towns of Watford, Arkona and Thedford, Ont. The undertaking will be proceeded with at once.

As a result of a recent meeting of the citizens of Lethbridge, N. W. T., it was decided to organize a local electric and power company with a capital of $25,000. A committee of five was appointed to open a stock book.

The annual report of the Montreal Street Railway shows there has been an increase of 50 per cent. in the passenger traffic during the last three months. The year's business netted a profit of $93,880.21, as against $60,361.71 the previous year.

The Ottawa Board of Trade has appointed a deputation to wait upon the Dominion Government, to urge that action be taken in conjunction with the Imperial authorities, to push forward the scheme for the construction of a cable between Canada and Australia.

The electric cars on the streets of Victoria, B. C., are said to be much larger than those in use in Eastern cities, being capable of holding nearly 100 passengers. They also run at a much higher rate of speed. The road connecting Vancouver and New Westminster covers the distance between the two cities, 14 miles, in 50 minutes.

The Ottawa Electric Street Railway Co. has applied to the Ontario Government to be given three small islands in the Ottawa River, a short distance from the city. Should the request be granted, the intention of the Company is to extend its tracks to the river banks, construct a bridge from the mainland to the islands and establish a summer resort.

A convention of the railway telegraphers from all parts of the continent will be held in the City of Toronto, on the 15th of May next. It is expected that 300 to 500 delegates will be present. The membership of the Order of Railway Telegraphers numbers about 30,000. The Order has on hand a protective fund amounting to over $40,000 and a rest fund of $30,000.

The Legislature of British Columbia, at its next session, will be asked to grant incorporation to the Kalso City Electric Light and Power Co. Ltd. The Company propose to erect and operate electric works in and about Kalso City, which is situated in the West Kootenay district. The promoters of the Company are S. H. Green, F. E. Coy and B. H. Lee.

Action has been entered by the Dominion Government in the Exchequer Court, to recover from the town of Port Arthur the sum of $1,596, duty on 266 tons of steel rails, used in the construction of the electric street railway of that place. It was decided some time ago that rails for electric street railways should be classed as tramway rails and consequently should be subject to duty.

The Hamilton City Council has refused the request of the Hamilton, Guelph and Beamsville Electric Railway Co, for a bonus of $50,000 to aid the company in the construction of its line. It is understood that this decision will also apply to the proposed Radial Electric Railway Co., and the Guelph and Waterdown Company. The promoters of the Beamsville road, when asking for the bonus, stated that the road would not be constructed without it.

The attorney for the Toronto Street Railway Co., while in Detroit recently, stated that the company were perfectly satisfied with the arrangements with the city of Toronto. The gross receipts last year were upwards of $800,000 and the receipts for next year are expected to exceed $1,000,000. Last year the company paid 8 per cent. and $800 per mile for single track to the city. Should the receipts next year exceed $1,000,000 the company will have to pay 10 per cent. to the city.

A citizen of Toronto recently brought action for damages against the Bell Telephone Co. for having cut branches off shade trees overhanging the street in front of his premises. The Company alleged that the branches interfered with the use of the wires of the telephone system which they had contracted with the city to maintain. The Court of Appeal held that the plaintiff had no interest in or title to the trees growing in the street sufficient to enable him to complain of the cutting. The Court likewise held that as the branches overhanging the street, growing within the plaintiff's grounds, were not a nuisance and in no way interfered with the use of the highway, the defendants had no right to cut them.

Some time ago the township of Etobicoke passed a by-law granting a bonus of $20,000 to aid the construction of the Toronto and Mimico electric railway. The by-law under which the bonus was granted provided for the completion of the road by the 31st October, 1891. The road was not completed by that date, consequently the object of the by-law was lost by default. It is said, however, that the promoters of the railway are rather pleased than otherwise at the way things have turned out, as an appeal had been taken from the decision of the court sustaining the by-law, by parties opposed to the payment of the bonus. Under present circumstances the company will escape the costs incident to this appeal, amounting to about $759, and will shortly have the by-law again submitted and expect to succeed in having it carried.

The conditions of the agreement which the city of London has just made for the construction of an electric street railway provide that the work of building the track must be begun between Nov. 15, 1892, and March 15, 1893. Seven miles of the railway must be completed, and the electric cars running thereon within two years. At the end of 20 years the city may, after six months' notice, assume the ownership of the railway on payment of its value, to be determined by arbitration. The company will pay yearly to the city $100 per mile of single track and $200 per mile of double track, if the gross receipts of the railway are $60,000 a year. The company will also pay on all gross receipts under $100,000, 5%, between $100,000 and $125,000, 5½%, between $125,000 and $150,000, 6%, between $150,000 and $175,000, 6½%, between $175,000 and $200,000, 7%, over $200,000, 8%.

One of the large expenses of a street railway electric power plant is that arising from the burning out of the armatures of motors, which results sooner or later, with almost every machine in service. To start a car requires, of course, the expenditure of more electrical energy than is necessary to keep one in motion. This excess of electrical energy, when applied for the purpose of starting a car, has the effect of severely shocking the armature, which results in burning it out. The same effect is shown in stopping a car, as the sudden check in current, which must result, shocks and burns the coil on the armature. The force thus turned on for starting varies greatly according to circumstances, and it might not be precisely the same at any two times of the many which occur in a completed trip. The inertia, also, which is to be overcome by the motor, varies even more often according to the load, grade and state of soil; while the discretion of the driver, in turning on current in proportion to his load, can never be counted on with any degree of certainty. A mechanical regulating clutch has been brought out in Philadelphia, by which the machinery is started so gradually that only one-fourth of the force is permitted to enter the motor at once which would enter without the application of the clutch, and, therefore, the burning out of an armature is an absolute impossibility. After a car is in motion, it is claimed it can be stopped and started without interfering with the electrical energy or increasing it in the slightest degree. The motor runs continuously, but only works when the clutch is thrown in contact.

NOTES.

When a hand-hole plate or flange joint is to be packed it is well to have in mind the fact that it will require re-packing sometime, and do the work with a due regard for the future. It is the custom of many to cover plate surfaces and both sides of the gasket with a sticky mixture of white or red lead and oil, the object being to fill all the cavities that may be in the iron that is not touched by the gasket, and in hardening prevent a leak. The lead well does its work, but when from any reason it becomes necessary to break the joint and make it up anew, the conviction is forced upon the mind that while white or red lead makes a staunch joint it also makes a great deal of work in cleaning it for the new, as the lead either dried or burned fast, is very difficult to remove, requiring a scraper and a considerable amount of muscular energy. It is very seldom that such a paste is required—it seems advisable with hemp—and it is usually more a desideratum to have the packing remove easily than to burn fast.

We dropped into the engine room of one who is glad to learn, says the *Boston Journal of Commerce*. He was having trouble with an inspirator, and was the more troubled because the water line was fast disappearing, and the "blamed thing was broken and wouldn't start." It was no consolation that others had trouble with an inspirator before, and the same trouble, in fact, which was hardly the fault of the inspirator. The inspirator was fed from a tank overhead. The valve on the inspirator leaked, from a bit of grit getting under its seat, so that the steam entering through the suction-pipe into the tank rapidly converted the water therein to such a temperature that condensation was rather out of the question. The engineer did not notice how hot the water was in his tank, but started and restarted the inspirator as often as it broke. All we could suggest was that he close the valve from the suction-pipe of the inspirator to the tank, so no more steam could enter, and hold the water-valve in the tank open until enough water had run in to cool the whole down to a temperature where it would draw, and in future keep steam out of the tank. In this way the trouble was overcome, and with cool water it worked nicely.

A CONTRIBUTION TO THE THEORY OF THE TELEPHONE.

In the development of the Bell receiver, it was found in practice that a louder effect could be obtained by employing a magnetized core instead of a plain soft iron core. This appears to be at variance with ordinary experience, it being generally supposed that for a maximum effect, the core in electro-magnets should be of soft iron.

An explanation of this, which seems to be commonly received, attributes the improved results to the diaphragm of the receiver being kept permanently in a taut condition, and being thus, for some reason, in a better condition for taking up the vibrations than when left relaxed. However, no very clear ideas upon the subject seem to be current.

For some time past Dr. F. T. Trouton has been experimenting, with the object of clearing up this point, the result of which is to almost entirely refer the improved effect, obtainable by permanently magnetizing the core of the telephone, to the fact that the mechanical force on the diaphragm or armature of the electro-magnet, is proportional to the square of magnetic force. He points out that the variations in the force of the diaphragm, and consequently its aptitude of variations, will depend on the permanent magnetization, as well as on its vibration produced by the currents passed through the telephone. Or to look

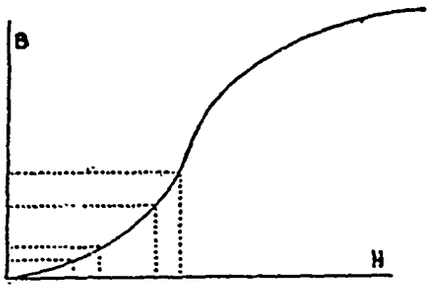


FIG. 1.

as it another way, it is important that, initially, the armature have strong magnetic poles ready to be acted on by this variation. (This would suggest magnetized steel diaphragms for louder effects)

Another advantageous result arising from permanently magnetizing a soft iron core by the addition of a steel magnet, as in a common arrangement of the telephone, probably is, that the permeability of the soft iron is increased thereby; so that the magnetic force at the armature, arising from the current, is greater than were the current to act on an initially unmagnetized core. This effect is probably always unimportant compared with the last.

The effect here alluded to may perhaps be better understood by reference to the well-known curves of magnetization (fig. 1), where it will be seen at once that equal small variations in the magnetic force produce effects in the magnetization dependent in amount on the initial position on the curve.

An apparatus which Dr. Trouton found convenient in his investigation is shown in fig. 2. It consisted of an ordinary tam-

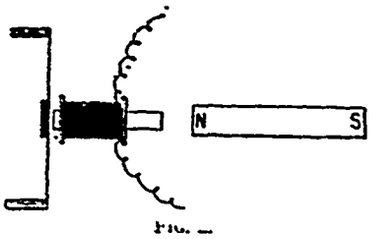


FIG. 2.

bourine, armed in the centre with a little piece of iron, which thus could be made to vibrate by an alternating current passed through an electro-magnet with a soft iron core, placed "telephone wise," close to the little piece of iron. The core could be permanently magnetized to the extent desired, either by a current passed through an additional coil wound on for the purpose, or by bringing up in a line with the core a permanent magnet to a variable distance.

With such an apparatus it is easy to show the gain in sound brought about by permanently magnetizing the core of the electro-magnet. For this purpose, an alternating current is employed of insufficient intensity to affect the diaphragm much; one then brings up the permanent magnet to the position shown in the figure, upon which the sound is found to be immensely improved. A similar result, of course, can be obtained by a permanent current sent around the additional coil.

To distinguish between the parts of this improved effect due, respectively, to the two cases mentioned above, one can either connect up the additional coil wound on the electro-magnet with an electro-dynamometer or with a telephone. If the improved action on bringing up the steel magnet were entirely due to the second cause (namely, the fact that then the same current is able to produce more lines of force in the iron than before), the deflection of the dynamometer, or the sound in the telephone, would increase in like proportion with the loudness of the tambourine. The experiment proves that though there is undoubtedly a slight increase in the number of lines of force, shown by a slight increase in the deflection of the dynamometer, the chief improvement is to be referred to the other cause.

Dr. Trouton made a similar experiment with the additional coil wound on the armature instead of on the core. This was effected by taking a rather thicker piece of iron than that which had been previously employed for the arming of the daiphragm of the tambourine. In connecting up a telephone with a coil, it could be arranged so as to have the sound from the telephone and from the tambourine, with the steel magnet removed, of equal intensity; then, on bringing up the magnet as before, the sound of the tambourine is found to be far and away louder than the telephone.

Lest it might be thought that the increased effect could be due to the diaphragm coming nearer to the electro-magnet, in consequence of the attraction arising from the permanent magnet, it may be mentioned that similar effects are produced on placing the magnet on the opposite side to that shown in the diagram. In this position, the diaphragm lies between the magnet and the electro-magnet, and consequently tends to be drawn *further* away from the magnet.

Dr. Trouton says that a somewhat curious effect is to be observed with this apparatus on employing an intermittent current instead of an alternating one. With an alternating current a continuous increase in sound is, of course, produced indifferently by either pole of the permanent magnet, as it is brought up from a distance to the position of contact with the core. One pole effects, as before, a continuous increase in the intensity of the sound as it is brought up from a distance to the position of contact with the core; but the other pole, at first, as it is brought up, steadily *diminishes* what small amount of sound the current alone may be capable of producing; reaching a minimum the sound still begins to increase, and continues doing so until the position of contact is arrived at. In this case the permanent magnet is opposed, (that is, lies in the opposite direction) to the magnetization produced in the soft iron by the intermittent current. The position of minimum sound evidently is that in which the average permanent magnetization resulting from the intermittent current is just neutralized by the permanent magnet. For, as we have seen already, a small change in the magnetizing force applied to an electro-magnet should produce least mechanical force on the armature under such circumstances.

In the current issue of the *Philosophical Magazine*, Dr. Trouton deals with this subject under the title "The Theory of the use of a Permanently Magnetized Core in the Telephone." Although we have made a very full abstract of this paper, our readers will find much more that is interesting in the original. Towards the end of it is an account of some rough experiments made by Dr. Trouton to obtain quantative results, and those obtained agree with the theory as well as could be expected.—London *Electrical Review*.

A section of the Alabama code authorizes the consolidation of manufacturing corporations. The Supreme Court of the State held, in the case of Beggs vs. Edison Electric Company, that electric light companies are manufacturing corporations within the meaning of this section. The court said: "When we take into consideration that the electricity now used and applied in the ordinary business of life is essentially the product of skill and labor, we can find no difficulty in reaching the conclusion that a corporation engaged in generating, storing, transmitting and selling such electricity, to be used for lighting purposes, is a manufacturing corporation. In reaching this conclusion we are not without precedent. The very point we have in hand was ably considered in the case of People vs. Wemple, 129 N. Y. 543. In that case the Court of Appeals of New York were unanimous in the opinion that the electric light company was a manufacturing corporation."

ELECTRICAL LESSONS FOR STUDENTS.

THE first question invariably asked by a student is: "*What is electricity?*" To this no more satisfactory answer can be given than to the questions, what is heat, light, gravity, etc.?

If electricity, light and heat are not the same, they are very closely related. The question with us should be not what is electricity, but how best to apply it.

As we know how to obtain and apply artificial light and heat, so also do we know in a measure how to obtain and apply artificially produced electricity.

The simplest and most direct way to generate electricity is by means of the voltaic cell or battery, but the method of generating electricity to operate devices coming more within the range of our lessons is by the dynamo machine.

A voltaic cell consists of two metallic plates of different metals, submerged in a solution which will very readily and rapidly attack one plate without affecting the other.

By connecting a wire to each of these electrodes and attaching the free ends of the wires to a galvanometer, the indicating needle thereof will instantly be deflected and show that a current of electricity is passing through it.

A *voltaic cell* is, then, an appliance for artificially producing electric energy from chemical action. The metal plates of the battery are called the *electrodes*, the one attacked being the *positive* and the one not attacked the *negative*.

The battery solution or exciting fluid is called the *electrolyte*. For powerful currents such as are required for light and power, the solution is composed of some of the acids diluted more or less with water. When the wires from the cell are joined together, through the galvanometer, it is said that the *circuit* is complete or closed, *i. e.*, that there is no break in the chain of conductors.

The *circuit* is said to be open when the chain is severed at any point throughout its entire length. Simply connecting together the battery wires without the galvanometer or other device in *circuit* would be called *short circuiting the battery*. The result of such short circuiting would result in the rapid destruction of the battery.

By the *opening* and *closing* of the electrical circuit by means of a suitable lever called a *key*, the telegraph operator transmits his message. A short depression of this key will indicate at the distant end of the telegraph line a *dot*, while a longer depression will indicate a *dash*; these dots and dashes are grouped together to represent the alphabet.

The galvanometer is an instrument for indicating the presence of electricity. It is to the electrician what the mariner's compass is to the sailor. The galvanometer, like most other electrical instruments, is exceedingly simple. It consists essentially of a freely suspended or pivoted *magnetic needle* around which is wound a number of convolutions of fine *insulated* wire. The deflection of the needle, with the same power, may be increased by increasing the number of convolutions of wire. Instruction for making a simple form of galvanometer will be given when the subject is reached.

The galvanometer is simply an instrument employed to show the presence of an electric current, or to show when electricity is passing through the circuit of which it forms a part.

The circuit is the path over which the current flows. The ordinary galvanometers are graduated simply in degrees, which by themselves have no actual value. The galvanometer in all its various forms consists of a coil of *insulated* wire having a magnetic needle freely pivoted or supported within, and so that

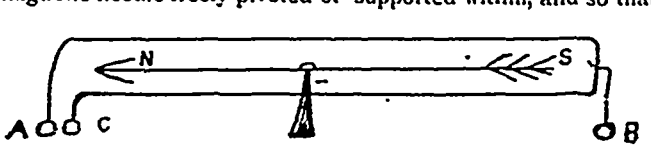


FIG. 1.

when a current passes through the wire it will have the greatest effect upon the needle. The best results are obtained when the coil and magnet are close, and when each convolution of the coil lies in a plane perpendicular to the needle.

The magnets of the class of galvanometers called *Detectors*, are pivoted in a vertical plane having one end made slightly heavier than the other, so that it hangs with the pointer perpendicular. A current passing through the hollow coil will cause the needle to be deflected to the right or left, according to the direction of the flow.

The principle of construction of the galvanometer may be understood better by reference to Fig. 1, in which N S represents the freely pivoted needle, and A B C the connectors to an insulated wire which surrounds it. When the two wires from a battery are conducted to A and B, the current will flow only through the upper wire and the magnetic needle will be deflected only slightly. On removing the battery wire from A and connecting it with B, and the other battery wire from B and connecting it with C, the current will flow through the lower wire only, and under like conditions the action on the needle will be the same, so that when the current passes in the same direction the action is the same through the upper or lower wire. On removing the battery wire from B and connecting it with C, the deflection of the needle will be considerably increased, as the wire below will exert a like influence on the needle and in the same direction as the wire above, and the deflection of the needle will thereby be increased; and so on, will the deflection of the needle be increased for each and every additional turn of the wire forming the hollow coil which surrounds it.

By connecting one battery wire to both A and C, and the other battery wire to B, we will, so long as the wire above and below the needle are equal, obtain no deflection. The reason for this is that the current is divided equally between the two wires and the influence of one wire on the needle is counteracted by the influence of the other, which is reversed. Galvanometers constructed on this principle are called differential. By increasing, decreasing, or in any way altering the resistance of one of the wires only, we again get a deflection. This fact is taken advantage of and will be fully explained when dealing with the construction of the apparatus for testing.

The needle tends, at all times, on the passage of the electric current through the wire, to set itself at right angles to the wire, and this it does in proportion to the number of turns of the wire and the strength of the current.

If we reverse the position of the battery wires by connecting the one removed from A to C and the one removed from C to A, we shall also reverse the direction of the deflection of the needle, and this action will be due to the change made in the direction of the passage of the current.

The current in passing through the hollow coil of the wire, produces in the space surrounding it a *magnetic field*. It is this temporary magnetic field which acts upon the *permanently* magnetic needle and causes it to be deflected.

From the above you have learned that a current passing through a fixed wire which is supported parallel to a magnetic needle, will cause the needle to be deflected or to take up a position at right angles thereto, in proportion to the strength of the current flowing, and that by increasing the number of wires or convolutions of the insulated wire around a freely pivoted magnetic needle, it will, with the same current, likewise increase the deflection of the needle.

We have learned also that the electric current, as it flows through the insulated wire, causes each turn, half turn or complete convolution, to act for the time being as though it were itself a magnet, and that the space around the wire thus influenced is called the magnetic field. Further, that when a freely suspended magnetic needle is at rest it will have its ends directed to the North and South pole of the globe, and that when thus influenced it is said that the action is due to the earth's magnetism.

In all horizontal forms of galvanometers, before the current is allowed to pass for taking a reading, it is necessary to place the instrument so that the needle comes to rest at zero under the influence of the earth's magnetism. The deflection of the needle caused by the passage of the current will determine its strength.

The word *poles* is, in general, applied to the ends of magnets, to the ends of batteries, to the terminals or ends of the armatures on dynamo machines, electric motors, etc.

It is a fact no doubt well known to all our readers that one *pole* of a magnet will repel the like *pole* of another magnet, and that unlike poles will attract each other: and that the expression *poles* is generally understood as meaning the ends of magnets, batteries, etc.

The poles of an artificial magnet are generally designed to be

at their ends, but they are always a little distance therefrom. They are distinguished one from the other by calling one the South and the other the North pole. The poles of a battery, as before stated, are its ends. The terminating plates or electrodes in a battery composed of a number of voltaic cells are distinguished one from the other by calling one the *negative*, the other the *positive* pole.

The negative terminating plate or electrode is the positive pole, while the positive terminating plate or electrode is the negative pole of a battery. The above should be very firmly impressed on the memory, as this apparent contradiction is a common source of trouble.

Speaking generally, we may say that the *volt-meter* and the *ampere-meter* are simply galvanometers which have their coils especially wound and their dial faces carefully graduated and marked, so that the volts or amperes in a circuit of which they are a part, can be read directly as the weight on a pair of scales or as the pressure on a steam gauge.

A *volt* is the *unit of electro-motive force*, and it is symbolized by E. It is equivalent to the difference of potential between two points, or it is that force which will maintain a circuit of one ampere in a wire having a resistance of one ohm.

The volt-meter is, then, an instrument for measuring the electro-motive force or the E M F as usually written, which is expressed in *volts*.

The E M F is the force which moves electricity. It is sometimes called electric pressure, difference of potential, electric force and potential. The only difference between electromotive force and potential is that the former relates to the *conductive* while the latter relates to the *inductive* circuits. The electro-motive force expresses to the electrician what steam in a boiler does to the engineer.

The *ohm* is the *unit of resistance* and is symbolized by R. One ohm is the resistance through which one ampere of current will flow when driven by a pressure of one volt of E M F.

Electrical resistance is the opposing force to electro-motive force: Resistance to electricity exists more or less in every electrical circuit, just as resistance exists in water pipes to the flow of water through them. The metals are the best conductors of electricity because they offer, compared with other metals, less resistance to the passage of the current. A good conductor renders the same sort of service to the electrician as the large water pipes do to the engineer.

The greater the E M F in proportion to the resistance of a circuit the greater will be the strength of the current, and vice versa. The greater the resistance of a circuit the less will be the current strength. Thus by doubling a given conductor, the strength of the current will be doubled.

The *ampere* is the *unit of current* per second. It is symbolized in formula by C and is that quantity of electricity which flows per second through a resistance of one ohm, at a pressure of one volt of electro-motive force. The ampere-meter is, then, an instrument employed for measuring this current strength, or the intensity of the current in amperes.

The current strength is always directly proportional to the electro-motive force. It becomes proportionately less as the resistance of the circuit becomes greater. When an electro-motive force of one volt drives a current through a resistance of one ohm, that current is said to have an intensity of one ampere.

The fact that electro-motive force and resistance bear a relation one to the other was discovered by "Ohm" who propounded the law of electricity in motion, which now guides the electrician in his calculation. Knowing the current strength and the rate at which the E M F puts it in action, we can readily find the work done, as by multiplying the volts and the amperes we obtain the energy in watts.

The *watt* is the unit of energy or power and is equal to about 1 746 of a mechanical horse-power. With a constant resistance the current is proportional to the electro-motive force with the same difference of potential and it is halved by doubling the resistance In other words, if we, with a given potential, get an unit of current over a wire one mile long, we get but half this unit of current over the same conductor when it is increased in length to two miles.

Ohm's law expresses the above thus: "C," current strength, "E," electro-motive force; "R," resistance.

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

The current in amperes may be found by dividing the E M F in volts by the resistance in ohms.

To find the electro-motive force in volts of a circuit, it is simply necessary to multiply the current in amperes by the resistance in ohms. The resistance of a circuit may be found by dividing the electro-motive force in volts by the current in amperes.

The *colombe* is the *unit of quantity* and it is symbolized by Q. It is that quantity of electricity which is given by one ampere in one second.

The next most important effect for us to study is the action of the electric current on a bar of soft iron enclosed within a coil of insulated wire in place of the permanently magnetized steel needle we have been dealing with.

Such an arrangement is called an *electro magnet*. The soft iron is called the *core* and the coil of insulated wire surrounding it the *helix*.

A current of electricity passed through the helix will act upon the soft iron core within as it did upon the permanently magnetized needle of the galvanometer. In this instance, however, the iron cores are converted into a powerful electro magnet, one free end of which is said to have North and the other free end South polarity.

The nearer the coils of wire forming the helix are to the soft iron core the greater will be the magnetic effect in the iron when the circuit is completed. A piece of Norway or Swedish iron placed with a coil of wire will, when a current is passed through the coil, become magnetized in proportion to the number of turns of wire around the iron, in proportion to the strength of the current passing through the coils, and in proportion to the distance between the coils of wire forming the helix and the core.

If we place a bar of soft iron in a helix of insulated wire, the ends of which are connected in circuit with a voltaic battery and a key for opening and closing the circuit, we may energize this core at will by simply depressing the key so as to close the circuit. This is the principle of the electric bell and the Morse and other telegraphic instruments. It will readily be understood that the closing of the circuit by depressing the key will act upon the iron core so as to make it a magnet, but only for the time during which the circuit remains closed. On arresting the flow of the current by releasing the key, the magnetic effect in the iron core is also arrested.

The softest iron and the best should alone be selected for the cores of electro magnets, for the reason that good, soft iron immediately parts with its magnetism when the influence of the current is removed by opening the circuit. Whereas hard iron or steel will retain magnetism in proportion to their hardness and consequently will respond to the action of the current proportionately slower.

The quality of the iron for the cores, armatures or field magnets of electrical machines is one of the most important points to be considered in their construction.

Of course work is done in energizing this piece of iron so as to make it an electro-magnet capable of sustaining a considerable weight.

It may be a question with some as to what the source of this energy is. When the current from a battery is emyloyed the energy to do the work is so far primarily due to the chemical energy in the cells which on being converted ints electric energy, act upon the iron so as to cause it to develop energy in the form of magnetism.

When a steam engine is used to drive a dynamo machine to generate electricity the coal burned is so far the source of energy.

It should be remembered that in every transportation of one form of energy into another there is a very considerable loss, therefore the more direct the means of producing and utilizing the current the less will be the loss. A great part of the energy expended in producing the electric-magnetic energy in the soft iron, will, if the core be removed, be expended in heating the wire. The chemical energy of the battery will likewise be expended in producing heat energy in the wire of an helix.

This heating effect will be dealt with presently as fully as space will permit. The heating effect is proportionately less as other work done by the current is proportionately greater.

We have stated that the effect of temporarily closing the electric circuit through the helix is to temporarily magnetize the soft iron core. We may say that the effect of closing a voltaic battery circuit through an electro-magnet is to convert the chemical action developed in the battery into magnetic energy developed in the soft iron core of the electro-magnet. If the core is removed from the helix the same amount of work is still done, but it shows itself in a different way. In this instance the chemical energy developed in the battery would appear in the helix and connecting wire as heat energy.

Iron is the only metal which can be practically employed for electro-magnets, although nickel is acted on in like manner by the current, but in a much slighter degree and at much greater cost. The object of insulating the wire of the helix is to compel the current to travel from one end of the wire to the other.

If the wire actually touched, *i.e.*, made metallic contact at any two points between the ends, the greater part of the current would pass at the point of contact, instead of passing around the convolution of the loop, which would be intermediate in the wire and between the points of contact.

Thus you will understand the necessity for perfect insulation in electric wires.

The current will at all times take the path of least resistance, and rather than go round the coils it will jump across if the insulation is not sufficiently good.

Fig. 1 represents a straight electro-magnet. This, if bent at its centre so that its poles approached each other, would then be called a horse-shoe. The horse-shoe form of electro magnet is considered the best, and in this form it is used in the principal electrical devices.

Iron, then, is employed because in a remarkable degree it has the property of acquiring and losing magnetism very rapidly.

We have learned that an electro-magnet immediately acquires magnetism when a current of electricity is passed through the

wire encircling the core, and that immediately on the cessation of the flow of electricity it almost as readily loses its magnetism. It will readily be understood from Fig. 1 that the closing of the circuit by depressing the Key K will allow the current to flow through the wire around the core and make it a magnet, but only for the time during which the key is depressed and the circuit remains closed. On arresting the flow of the current by releasing the key, the magnetic effect in the iron core is at the same instant also arrested. The softest and the best iron only should be used for the purpose for the reason that cores of electro-magnets composed of good, soft iron retain but little magnetism when the influence of the current is removed by opening the circuit, whereas, if made of cast or an inferior quality of iron the magnetism is retained and the action is sluggish.

Fig. 2 diagrammatically represents an electro-magnet of a form very generally employed for telegraph instruments, electric bells, etc. N and S are simply pieces of round Norway iron screwed by means of an iron screw, or riveted with an iron rivet in the plate B.

It is of the utmost importance that the cores of iron make surface and solid contact with the iron yoke piece B.

C is a simple spring contact key for temporarily closing the electrical circuit when depressed, normally it leaves the circuit open. By depressing the key until it comes in contact with the anvil O, the current will flow from the battery through the key,

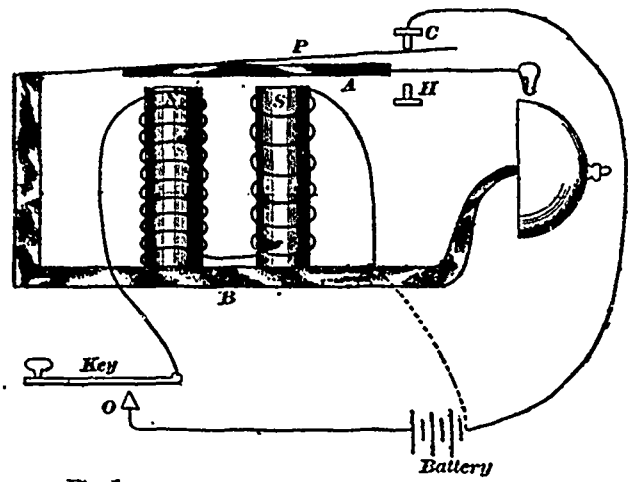
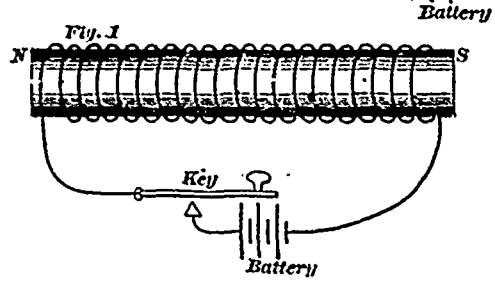


Fig. 1



out by the anvil O, through the helix surrounding N S, to the metal frame along which it travels to the armature A, out by the spring to S and back to the battery at the opposite pole to that from which it entered. The effect of the depression of the key is then to magnetize N S, which attracts the soft iron armature A until the ball at its free end strikes the gong. The instant the hammer strikes the gong the spring will be drawn out of contact with the screw C, and the circuit will be again open for an instant and until the spring and screw C come again in contact. N S will lose their magnetism on the opening of the circuit, and the armature will instantly be carried back by the tension of the spring, and the current will again be established and so on, causing the armature to vibrate and the hammer to strike the gong at each vibration. This is the principle upon which all vibrating bells are constructed.

There is very little difference between the action, etc., of an electric bell and the *Morse* telegraph instruments. If, for instance, we remove the long spring P from the bell armature A, so that the armature plays between the studs C and H, and if we also remove the wire from C and connect it with the end of the helix on S, we then have a simple Morse telegraph instrument, which may be read by the sound of the armature beating against the studs.

If we substitute a stylus for the hammer at the end of armature and cause a ribbon of paper to travel above, but within striking distance thereof, we then have a Morse recording telegraph instrument.

We have already stated that dynamo machines are divided into two classes, viz., *alternating* current machines which, as their name implies, supply only alternating currents, and *direct* current machines, which generate a current always flowing in one direction. Each machine can use either permanent or electro-magnetic fields.

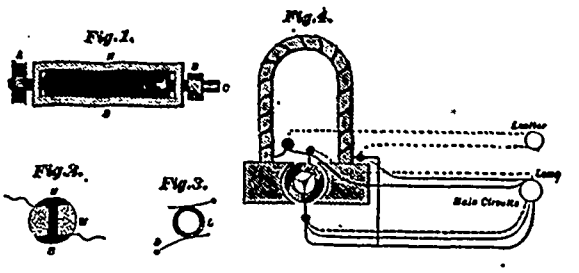
By the difference of the winding and arrangement of the wires, these two classes, *i.e.*, alternating and direct current machines, are again, to meet special arrangements, divided into what are termed *series* and *shunt* wound machines and different combinations thereof.

The series machines give a constant current with a varying electro-motive force, while the shunt wound machines give a varying current and a constant electro-motive force, one being the opposite to the other.

Then, again, there are self-exciting and separately-exciting machines, which may be either shunt or series wound, sufficient magnetism is always retained in the field magnets to feebly act from the start on the armature, which, as its speed of rotation is increased, cuts more *lines of force*, and in proportion thereto, generates a stronger current, which, passing through the field magnet coils in the proper direction, increases the strength of the field magnets, which again in turn so influences or acts upon the armature that it gives out a proportionately increased amount of electric energy. The self-exciting machine would appear to be an electric accummulator. A separately-excited machine is used with alternating current machines unless the latter have a permanently magnetized field.

The exciter is generally a small dynamo, or it may be a voltaic battery, placed in circuit with the field magnet only; its office being to magnetize the field to *saturation*. The commutator on an alternating generator, or machine, is required to convert the alternating impulses into a direct flowing current. Such convertion is sometimes necessary, but whenever resorted to it is attended at all times with a considerable loss of energy.

The alternating machines are more simple in construction and have the advantage of furnishing a higher E.M.F. at less cost than a direct current dynamo machine. They can also be advantageously employed for supplying incandescent lamps, especially on long circuits. For supplying arc electric lights, the direct current machines are best, as they are made simple to



manipulate. They can be used for both arc and incandescent lamps, driving motors or electro-plating, etc., whereas, to do more than to light incandescent lamps the alternating machines have to be furnished with special appliances which increase the cost and the complications.

We would recommend our readers, whose intention it is to build a dynamo machine for their own use, to build it on the Siemens pattern, as this is a simple machine to construct and will, to the amateur, give greater satisfaction than any other.

We may have something more to say regarding the converters and the special apparatus above alluded to. Although the forms of field magnets may differ so much in outward form, the same principles underlie all, as the object of the manufacturer is to construct a machine which will concentrate the greatest number of lines of force on each successive coil of the armature.

The different designs of armatures, although not so numereus as the different designs of field magnets, are far too numerous for us to attempt to describe here. We will, therefore, confine ourselves to two or three of the most simple and generally approved types, commencing with the Siemens and Gramme, which are among the oldest. It would be safe to say that nine-tenths of all the dynamos on the market are simply modifications of one or the other of these.

Fig. 1 shows a longitudinal view of the Siemens armature, N S representing the poles, W the wire, A the driving wheel, B the commutator, and C the shaft.

Fig. 2 represents a cross section of the armature, and Fig. 3 a cross section of the commutator, with the brushes D D resting thereon.

Fig. 4 shows a Siemens armature revolving between the poles of the field magnets. The thin lines represent the circuit or path the current traverses to make it a series-shunt or separately-excited machine. The heavy lines show the complete circuit and winding of the shunt system, and the dotted lines show the circuit of separately-excited field magnets, with winding and circuit complete.—*Scientific Machinist.*

LEGAL DECISIONS.

TELEGRAPHIC CORRESPONDENCE, AGENCY.—According to the decision of the Supreme Court of Minnesota, in the case of Magie *v.* Herman et al., where one commences a correspondence with another by telegraph he makes the telegraph company his agent for the transmission and delivery of his communication, and the transcribed message actually delivered is primary evidence, and if lost or destroyed its contents my be proved by parol.

FLUES IN BOILERS.

A boiler shell, with the pressure acting on it from within, is in a state of stable equilibrium; for if any small deformation is produced in it, for any cause, the pressure tends to remove the deformation and restore the boiler to the form of a true cylinder. A flue, however, with the pressure on the outside, is in a state of unstable equilibrium, for the pressure tends to magnify all deformations and to cause the flue to depart more widely from the cylindrical form. In other words, pressure tends to keep the shell of a boiler in its strongest shape, and tends to force a flue into its weakest shape. Flues, therefore, are elements of weakness in a boiler, and it is particularly important that proper attention be paid to them.

The U. S. Treasury rules for finding the strength of lap-welded flues are as follows (see *Amended Steamboat Rules and Regulations* for 1891): If the diameter of the flue is not less than 7 inches, and not more than 16 inches, and the length not over 18 feet, multiply the thickness of the flue, in

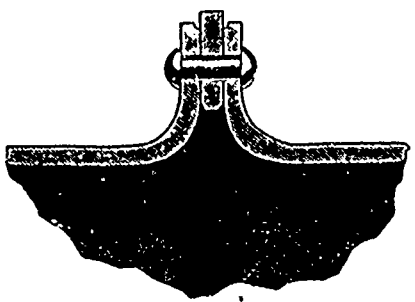


FIG. 1.—THE ADAMSON RING.

inches, by the constant number 4,400, and divide the product by the radius of the flue in inches. The quotient will be the pressure allowable. "For every foot or fraction thereof over 18 feet, deduct 3 pounds per square inch from the pressure allowable on an 18-foot flue; or, add .01 of an inch to the thickness of material required for a flue 18 feet in length for every three feet or fraction thereof over 18 feet." The thickness of such a flue as is described above is to be determined by the following rule: Multiply the radius of flue in inches by the pressure per square inch that it is desired to carry, and divide the product by the constant number 4,400. The quotient is the required thickness, in inches. "The thickness of lap-welded flues, however, shall in no case be *less* than the diameter of the flue multiplied by .022."

It is further provided by the Treasury department that "Lap-welded flues 7 inches, and not over 16 inches in diameter, shall be made in lengths of not over three (3) feet and fitted one into the other and substantially riveted; or in lieu thereof corrugated

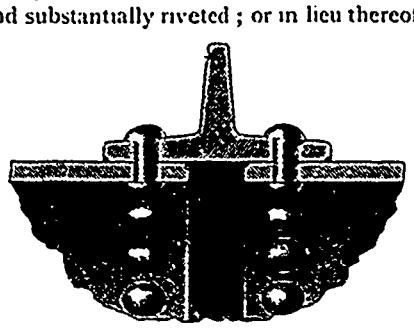


FIG. 2.—T-IRON RING.

to a depth of not less than three-fourths of an inch outwardly and at a distance of not over three feet between such corrugations: *Provided*, such corrugations are made without in any manner reducing the thickness of the material in the flue at the points of corrugation to less than the least thickness of the material in the body of the flue, or that such flues are made in sections of not over three (3) feet in length, and flanged to a width of not less than two (2) inches, and riveted substantially together with a wrought iron ring (see the cut of the Adamson ring), having a thickness of material of not less than the thickness of material in the flues, and a width of not less than two (2) inches riveted between such flanges."

Flues whose diameter is more than 16 inches and less than 40 inches are separately considered. Of such flues it is required that they "shall be made in lengths of not over three (3) feet, fitted one into the other and substantially riveted; or flanged to a depth of not less than two (2) inches and riveted together with a good substantial wrought-iron ring between each joint; and no such ring shall have a thickness of less than half an inch nor a width of less than two (2) inches." The steam pressure allowable on such flues is to be determined by the same rule as that given above for the smaller flues, *except* that in the place of the constant number 4,400 that is given above, we must use the constant number 2,840.

In the *Amended Steamboat Rules and Regulations* for 1892 there appears the following modification for the rule given above as applying to lap-riveted flues not over 16 inches in diameter: "But when such flues are used under a pressure of over 60 pounds and less than 120 pounds to the square inch, they may be made in sections of not over 5 feet in length and connected in the manner prescribed for sections 3 feet in length, and all lap-welded flues and tubes using 120 pounds of steam, and under, shall have a thickness of material of not less than the standard thickness. The following shall be the standard thickness of lap-welded flues and tubes from 1 to 16 inches in diameter using steam under 120 pounds to the square inch:

Outside Diameter.	Thickness	Outside Diameter.	Thickness	Outside Diameter.	Thickness	Outside Diameter.	Thickness
1 in.	.072 in.	2¾ in.	.109 in.	5 in.	.148 in.	12 in.	.229 in.
1¼	.072	3	.109	6	.165	13	.238
1½	.083	3¼	.120	7	.165	14	.248
1¾	.095	3½	.120	8	.165	15	.259
2	.095	3¾	.120	9	.180	16	.270
2¼	.095	4	.134	10	.203		
2½	.109	4½	.134	11	.220		

Although the foregoing regulations of the Treasury department relate to lap-welded flues, they would doubtless be also applied to rolled flues when used in the marine service, notwithstanding the fact that the rolled flue is somewhat stronger, on account of its more perfectly cylindrical shape. Rolled flues are used in land boilers to some extent in this country, and very generally in England and other parts of Europe. Until recent years it was not found practicable to roll them in lengths of more than three feet or so, and where they were fitted together at the ends, and riveted, the double thickness of metal at the joint served as a sort of stiffening ring, and unless the pressure to be carried was high, engineers did not consider it necessary to provide additional rings for securing the necessary stiffness and resistance to collapse.

The method of joining the sections of the flues that is referred to in the Treasury rules above given is illustrated in Fig. 1, which shows what is technically known as the "Adamson ring," from its having been first introduced by Mr. Adamson, in 1851. The ends of the section are flanged outward, as shown, and are securely riveted together with a ring of wrought-iron or steel between. This ring, which should be not less than half an inch thick and not less than two inches wide, is caulked on the outer side of the joint, and if the flue is large enough to admit of it, it is also caulked on the inside, as indicated in the cut. One of the important features of this joint is that both the flanges and the rivets are entirely protected by water. There is also no thickening of the flue by overlapping pieces, so that the joint is not likely to burn out. Mr. Adamson has submitted these flanged joints to severe experimental tests, which they withstood remarkably well. The only serious objection that has been urged against them is, that in case one of the segments of the flue should burn out, either on account of scale or for any other reason, it could not be replaced without removing the head of the boiler. This objection does not seem to us to have any great weight, because in many cases the flue comes so close to the shell that it is almost impossible to do a satisfactory job of riveting or any kind of a joint, without removing the flue from the boiler; and if there are projections of *any* sort upon it, it will be necessary, in removing the flue, to take out one of the heads.

Fig. 2 shows a method of uniting the parts of a built-up flue, which may be used with advantage in some cases, though we should prefer the Adamson joint shown in Fig. 1. Fig. 2 shows a ring of T-shaped wrought-iron which is preferably made in one piece and shrunk on the ends of the segments to be united; though it may be made in halves, if necessary, the two parts being riveted firmly together when in position, by running straps along the web of the flange on both sides near the joint, and

riveting through both straps and the web. When the flue is large enough to admit of it, the joint should be caulked both inside and out, as indicated in the cut. If the flue is too small for this, there is no necessity of having the abutting ends of the flue as far apart as they are shown in the cut. T-shaped wrought-iron rings, similar to that shown in the figure, and made in halves, are sometimes riveted directly to the flue, midway between the joints, when the flue, either through age, through increase of pressure or through faulty design, requires more stiffening than the builder has given it. Rings of angle-iron are also used for this purpose.

Fig. 3 shows a ring of steel, hoop-shaped in section, which is sometimes used in building up flues in the place of the T-iron

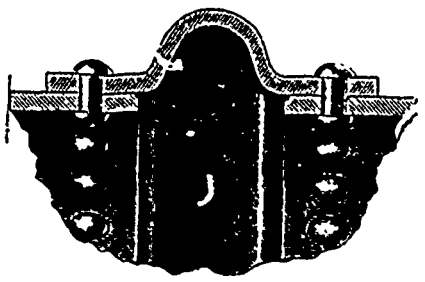
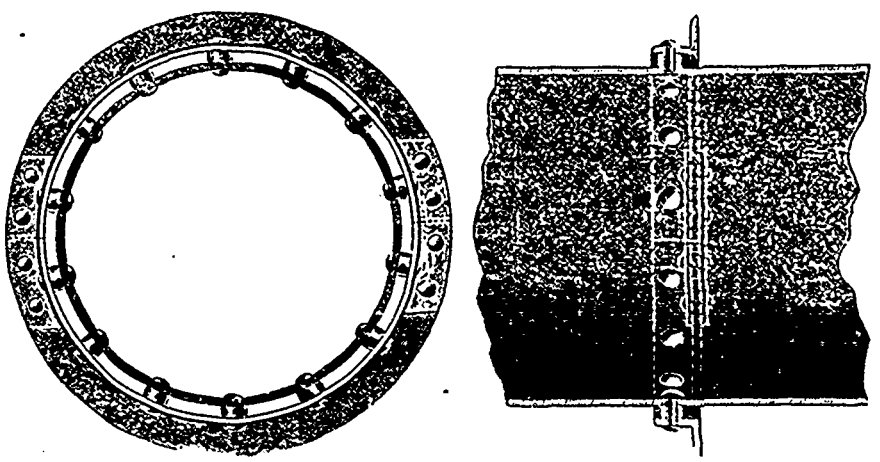


FIG. 3.—STEEL HOOP.

ring illustrated in Fig. 2. The advantage claimed for this form of joint is that it has a certain amount of elasticity, and that it yields sufficiently to prevent any very severe strain from unequal expansion and contraction in the flue and boiler. This form of ring should be made in one piece and be shrunk on, and then riveted. It should be caulked on the outside, and on the inside also, if the flue is large enough to admit of it.

At the present time, flues are rolled of all lengths up to 18 feet. If a longer boiler is required 21 feet long for example, it is customary to use a rolled flue 18 feet long, pieced out with an additional section three feet in length. The joint where the flue sections come together gives stiffness enough, ordinarily, to prevent the collapse of the shorter segment; but the long section should be supported by some additional means. Rings of angle-iron, or T-iron, like that shown in Fig. 2 may be riveted around the flue at intervals of from 3 to 5 feet, to give the necessary stiffness, or the device shown in figures 4 and 5 may be



FIGS. 4 AND 5.—RING OF ANGLE-IRON, WITH THIMBLES.

adopted. There is some liability to overheating when the angle-iron is riveted directly to the flue, yet this is often done without giving rise to any such trouble. The ring shown in Figs. 4 and 5 seems superior to the plain ring, however, because water can circulate freely between the rivets, cooling both the rivets and the flue, and greatly lessening the likelihood of overheating. It consists of a ring of angle-iron or U-iron made in halves, with the ends riveted together in a double-strap, as indicated in the cuts. There is a free space of about one inch between the ring and the flue, all around, and the two are kept apart by thimbles that are spaced 5 or 6 inches apart. The ring and the flue are secured to one another by rivets which pass through the thimbles, as shown, and are headed over inside of the flue and outside of the angle-iron or U-iron. These rings are used in England much more than in this country, because flue boilers are much more common there than here. It will be interesting, therefore, to quote the opinion of Mr. Henry Miller, Chief Engineer of the National Boiler Insurance Company, with regard to them, as he is thoroughly familiar with the best English practice. "The angle-iron," he says, "should not be less than 3 in. x 3 in. x 9-16 in. The ferrules between the hoop and the plate should be about one inch thick, [*i. e.*, one inch long], and the rivets should be spaced about six inches apart. With the exception of the part that requires riveting over, the rivet should be as cool as possible when it is inserted, as otherwise the excessive contraction in so long a rivet will be likely to induce such a strain as to fracture the head. The ferrules should fit tightly between the hoop and the flue, and the rivets should fill the ferrules." These rings are made in halves, as explained above, and the ends of the halves are made to butt together and are secured by securely riveting a double strap to the web of the ring where the joint comes, in the manner indicated in the cuts.

Mr. Miller does not recommend this form of ring for new boilers, nor do we, unless there is some special reason for it. It is often serviceable, however, when the flues of a boiler were originally made too weak for the pressure it is desired to carry. For new work we strongly recommend Mr. Adamson's joint, shown in Fig. 1, or the steel hoop shown in Fig. 3. A few years ago a ferry boat plying about New York City was built with rings of this sort around her flues, except that in place of the angle-iron shown in Figs. 4 and 5, half round iron 2½ inches wide and 1½ inches high was used. The rings were placed along the flues at intervals of about twenty inches, and the rivets were spaced 8 inches apart. This stiffening proved insufficient, and a vast amount of trouble resulted. In our opinion the rings used in this case were much too small, and were weak in shape. The flue was 36 inches in diameter, and in this form no strengthening ring was to be used at all, a heavy ring of angle-iron should have been employed in the place of the weak, half-round strips. If we remember rightly, the trouble was removed by the substitution of corrugated flues for the plain ones.

It may be well to say in this place that we do not approve of flue boilers as a general rule. There seems to be no especial advantage in them and they are inherently weaker than the tubular form. We believe that greater safety and economy, and more general satisfaction, can be had from tubular boilers than from any other form. Flue boilers are used in some parts of the country in sawmills, where refuse is burned for fuel; and we have known the owners of these mills to object to tubular boilers because they *were* economical. It was necessary, they said, to burn all their refuse, and if the boiler wouldn't do it, it was necessary to have separate furnaces constructed for the purpose. Nowadays, when all things are put to use and the word "waste" is nearly obsolete, we seldom hear this objection urged.

There are other points that should be mentioned in connection with flues, and we shall return to the subject in a later issue.—*The Locomotive.*

EXTENSION OF THE BELL TELEPHONE SYSTEM.

THE trunk lines of the Bell Telephone system were largely extended in Ontario during the last year, and greater extensions and improvements are projected for the coming year. New metallic through wires and wires for way stations are to be erected from Toronto to Barrie, Orangeville, London via Guelph and Stratford; from Chatham to Windsor, and from Hamilton to Niagara Falls, to complete the line from Detroit and Windsor through London and Hamilton to Niagara Falls and Buffalo, and thence to all points in New York and the adjacent States; also from Port Hope to Kingston, to put that city, with Belleville and the neighboring towns, in communication with subscribers in Toronto and points farther west.

The new pole routes will all be of the most substantial construction, and the wires of copper and doubled in all cases, so that the annoying effects of induction from electric railway and electric light currents will be done away with and the company able to offer to its subscribers who have metallic circuits to their exchanges perfectly silent lines.

The Bell Telephone Company at Buffalo, with its numerous connecting lines, will meet the Canadian company at the Falls, thus preparing the means for conversation between Toronto and New York and other American cities.

TRADE NOTES.

Messrs. Barber & Bates, of Meaford, are supplying a 24 inch Turbine water wheel to the Preston Electric Light Co,

The Reliance Electric Mfg. Co., of Waterford, Ont., report having sold a 150 h. p, generator for power plant at St. Catharines; also to Cook & Son, of the same city, two 25 h. p. and one 10 h. p. motor.

Messrs. F. E. Dixon & Co., Toronto, have just finished the manufacture of two belts for the Toronto Electric Light Co., the combined length of which is about 260 feet. The width of each belt is 33 inches.

The Royal Electric Co. report the following sales for November.—Gravenhurst Electric Light Co., Gravenhurst, Ont., 15 light arc dynamo, lamps and wire. Victoria Electric Light Co., Lindsay, Ont., 35 light arc dynamo, lamps and wire, 700 light alternator, lamps and wire, Standard Electric Co., Ottawa, Ont., 5,000 light alternator and transformers, Sherbrooke Gas Co., Sherbrooke, Que., 650 light alternator and transformers; Quebec and Levis Electric Light Co., Quebec, Que., 2,000 light alternator and transformers, Tooke Bros., Montreal, Que., 350 light incandescent, dynamo and lamps; E. Ives & Co., Coaticooke, Que., 650 light alternator and transformers; St. Johns Electric Co., St. Johns, Nfld., 50 light arc dynamo and lamps; Consolidated Electric Company, St. John, N. B., 125 h. p. generator for street railway; Hamilton Electric Light and Power Co., Hamilton, Ont., 1,500 light alternator, 125 h. p. generator for power purposes, 50 light arc dynamos; Toronto Railway Co., Toronto, Ont., 6 h. p., 500 volt motor; also a number of small motors and isolated incandescent plants. Up to date the company have equipped 1 cars for the Montreal Street Railway, with two 25 h.p. motors each, and have 14 more equipments ready to mount, a portion of which go to Winnipeg and Toronto.

For about two years past the Toronto and Richmond Hill Street Railway Co. have been making preparations to construct an electric railway to Richmond Hill. The County Council, at its session a few days ago, granted a franchise to the Metropolitan Electric Railway Co. to extend their lines over the same route, but were restrained by an injunction.

THE TELEGRAPH WIRE.

Thar's many a little tragic tale
Is spun un th' thrummin' wire,
Thar's many a sob, an' thar's many a song
Is sung to the hum o' th' wire,
We know by th' hum and th' thrum overhead
Thar's some un is born er thar's some un is dead,
As the news like th' lightnin', click! is sped
On th' telegraphic wire.

Thar's somethin about th yaller note
Thet th' sighin' wires send,
Thet makes a man's heart sneak up in's throat
Till he's torn the mucilaged end,
Fer maybe it tells ye ye re rich fer life,
An maybe it tells ye ye've lost a wife.
Thar's the hummin' o' peace an' th' thrummin' o' strife
On th' telegraphic wire,

Each click! click! click! strikes a note in the heart
That either'll cord er jar;
It is either a salve to soothe a smart
Er a probe to scratch a scar.
It may be th' honey th' busy bee sips,
It may be th' poison from waspish lips,
Thet is dropped from th' agent's finger tips
On th' telegraphic wire.

"J Kobn" in Winnipeg *Free Press*.

A SIMPLE MAGNETIC INDICATOR.

PROF. W. M. Stine, Physical and Electrical Department of Ohio University, writes as follows: Those having charge of dynamos would often like to know the distribution of the external lines of force in their machines, and much useful knowledge could be obtained in this way. If a magnetic needle is used, it is very apt to change its polarity; it can only indicate in one plane; and in no case can it present a complete picture to the eye. Iron filings, when sprinkled on glass or paper, give a more complete and satisfactory picture, but the use of filings is not only limited to horizontal positions, but they may be drawn into the dynamo and make serious trouble.

It occurred to the writer, while looking at the excellent maps in Carl Hering's "Dynamo Electric Machinery," that they could have been more accurately drawn had iron filings, at least, supplemented the magnetic needle. With this in mind, an indicator was prepared by placing about half an ounce of filings in a mortar and grinding them as fine as possible, and then placing them in a four-ounce flat bottle filled with concentrated glycerine. The high viscosity and specific gravity of the glycerine hold the filings in suspension and when the bottle is brought near the dynamo the lines of force appear very clearly. Since they are shown in three-dimensional space, they appear as they really are in space. When the bottle is held near the head of a bolt or sharp projection on the frame the magnetic discharging power of a point or edge becomes quite apparent. These projections are defects which still exist in many dynamos.

If the bottle is passed along a field coil, in many cases it will show that lines of force pass out thickly from a section of the winding and return a few inches farther along the coil. The relative intensity of the leakage can, at the same time, be seen. These are only a few of the many interesting facts which this simple indicator reveals, and other applications can be readily suggested. It is advisable to use a large flat bottle of clear glass in order to obtain the best results.

SPARKS.

The Western Union Telegraph company have decided to increase their capital stock from $13,000,000 to $100,000,000.

To prevent rubber gaskets from sticking to hand-hole plates, give them a coat of common whitewash or plumbago.

The Peoples' Electric Light Co. has been organized at Windsor, Ont., with a capital stock of $50,000, to operate the Edison plant.

A movement is on foot in Montreal to form a local association of the workmen in the employ of the telegraph, telephone and electric street railway companies.

The Nanaimo Electric Light Works have been sold by auction to Mr. Emerson, of New Westminster. The price paid was $25,040, which is said to be less than one-half the original cost.

The Canadian Whitney-Hoyt Electrical Instrument Co. has taken a five years' lease of part of the building formerly occupied by the Edison Co. at Sherbrooke, Que., with the object of manufacturing for the Canadian market.

A man whose wagon was damaged by coming in contact with an electric car in Hamilton, last July, brought suit against the Street Railway Co., urging that the accident was due to carelessness on the part of the motorman. The judge nonsuited the plaintiff.

What is said to be the largest generator ever installed in Canada, will be placed in the power station of the Ottawa Street Railway Co. The weight of the machine is 33,000 pounds, and it will furnish current for the operation of the road and for heating purposes.

The St. Henri Light and Power Co., which was recently granted a charter by the Quebec Legislature, empowering it to deal in electricity, gas and other illuminants, and to lay pipes or erect poles in any city, town or municipality in the Province of Quebec, including the city of of Montreal, will endeavor to secure the Montreal lighting franchise, both for gas and electricity on *the expiration of the present contract. It is said* that English capitalists have offered to take up all the available stock of the Company, the capital of which is placed at $1,000,000. A drop in the stock of the Montreal Gas Co. has followed the announcement of the above facts.

SPARKS.

Owing to the discomfort caused by smoke and gas in the St. Clair tunnel, the G. T. R. Co. are considering the question of operating the cars through the tunnel by means of electricity.

The Brantford Electric Light Co. has been incorporated with a capital of $150,000. Messrs. Wm. Buck, Geo. C. Schultz, H. B. Leaming, A. Watts, G. H. Wilkes and J. W. Digby are the promoters of the Company.

The London City Council propose to substitute for the taxes imposed on the Street Railway Co.'s property, amounting to about $600 a year, a mileage rate of $200 a mile. The company operate about 11 miles of track, which under the proposed arrangement would compel them to pay a yearly tax of $2,200.

Opposition to the construction of the proposed electric railway between Hamilton and Guelph, is said to have arisen in the latter city, on the ground that the new road would be likely to divert trade from Guelph to Hamilton, unless it were extended further north. The consent of all the municipalities through which the road is to run has been obtained.