SPARKS.

The Brooks Mfg. Co., of Peterborough, who were recently burned out, are again in good working order.

Mr. S. Worth, of London, Ont., has been elected a member of the Executive of the Order of Railroad Telegraphers.

The Canada Electric Light Company gives notice that it will apply to the Legislature at its present session for an act to amend its charter.

The Montreal Telegraph Company has paid a two per cent. dividend, amounting to $40,000. This is the eleventh dividend declared by the company.

The blowing out of the man heads of the boiler in the Vancouver electric light station recently, was the means of temporarily extinguishing the lights throughout the city.

The Times Printing Company of Hamilton will shortly operate their presses by electric power. The current will be supplied by the Hamilton Electric Light & Power Co.

THE

THOMSON-HOUSTON

INTERNATIONAL ELECTRIC CO.,

BOSTON, MASS.

Hereby announce that it is now manufacturing and prepared to manufacture and sell under the various Letters Patent of Inventions now held or owned by the Company and through its Agents in Canada,

The Toronto Construction & Electrical Supply Co.

Offers for sale and solicits orders for the following apparatus:

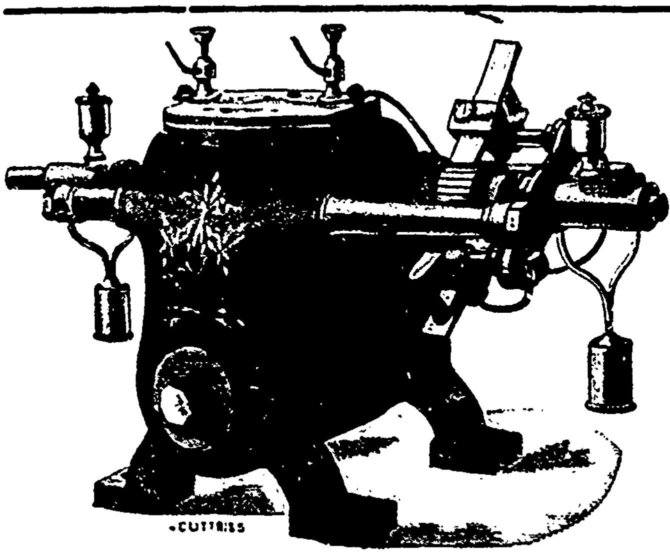
Alternaitng Incandescent Dynamos,
Continuous Current Dynamos,
Generators for transmission of power.
Motors, Railway Motors and Equipments,
Electric Reciprocating Drills,
Arc Lighting Machines.

The above may be obtained at reasonable prices by any person requiring them, from

THE TORONTO CONSTRUCTION & ELECTRICAL SUPPLY COMPANY,

WHOSE HEADQUARTERS ARE AT

No. 63 to 69 FRONT STREET WEST, TORONTO.



KAY ELECTRIC WORKS

NO. 263 JAMES ST. N. - HAMILTON, ONT.

MANUFACTURERS OF

DYNAMOS

For Arc and Incandescent Lighting.

MOTORS

From 1-8 H. P. to 50 H. P.

ELECTRO PLATING MACHINES AND GENERAL ELECTRICAL APPLIANCES. SPECIAL ATTENTION TO MILL AND FACTORY LIGHTING.

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Street Cars

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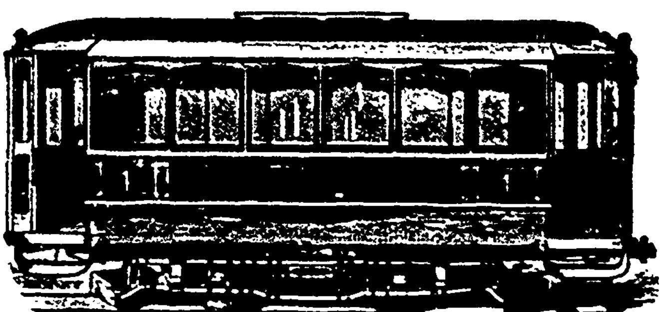
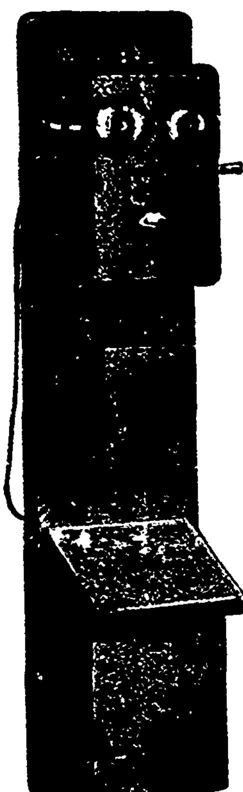


We also manufacture Horse and Trail Cars of every description.

PATTERSON & CORBIN,

ST. CATHARINES, ONT.



NOTICE OF REMOVAL.

WE beg to announce that we are removing this month to new premises,

749 CRAIG STREET,

where with larger accommodation and greatly increased facilities, we will be in a better position than ever to turn out our standard Main Line and Warehouse Telephones. Send for catalogue of Electrical Supplies of all kinds. Note a couple of sample testimonials:

WATFORD, ONT., Feb. 9, 1892.
T. W. NESS, Montreal, Que.

DEAR SIR,—We wish to secure four (4) of your telephones as soon as you can ship them to us. The ones we got from you last gave good satisfaction.

Yours truly, DS. McLEAY & AULD.

MILVERTON, ONT., Nov. 9, 1891
T. W. NESS, ESQ., Montreal.

DEAR SIR, The whole line is working first-class. Any one wishing to know about your telephones you can refer them to me. I think any person with ordinary intelligence could set them up.

Yours truly,
J. F. CATTERMOLE, M.D.

MONTREAL, April 7, 1892
T. W. NESS, ESQ., *City.*

DEAR SIR,—Replying to your favor of the ... inst., we beg to say that the telephone instruments which you put into our mill last year to connect our different departments are working very satisfactorily, and we find them a great convenience. We would certainly recommend anyone desiring a system of telephones for their works to adopt those made by you.

Yours truly,
DOMINION WIRE MFG. CO.

T. W. NESS

749 Craig Street, - Montreal.

CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

VOL. II. TORONTO AND MONTREAL, CANADA, JUNE, 1892. No. 6.

THE OTTAWA BLIZZARD.

WE present on this page an illustration of a scene whose like has probably never been witnessed outside of Canada, viz., the destruction of electric property on the Streets of Ottawa, by a blizzard on the 11th of March last. The electric wires became so laden with snow that for a distance of two miles in Rideau street, every pole broke beneath the burden.

THE WORK OF A BLIZZARD AT OTTAWA, ONT.

The Bell Telephone Company estimate their loss at $20,000; the telegraph companies were also heavy losers.

If such occurrences were likely to be frequent, the telephone company at least would require but little persuasion to induce it to place its wires underground.

At a meeting of the provisional directors of the Nelson, (B. C.) Electric Light Company, Limited, it was decided to offer 2,500 shares of the capital stock of the company for subscription. The contract for building the dam, flume and power house will be immediately awarded. The directors elected John Houston, President, J. A. Gilker, vice-president, J. Fred Hume, treasurer; and W. A. Crane, secretary.

Messrs. H. W. Darling, of Toronto; Marshall D Barr, manager of the Edison General Electric Company, Toronto; John Langton, of Peterboro; Samuel Insull, second vice-president of the Edison General Electric Company, New York, and Henry M. Francis, of Peterboro', are seeking incorporation as the Canadian General Electric Company, Limited, with headquarters at Montreal, and a capital stock of $1,000,000.

CANADIAN ELECTRICAL ASSOCIATION.

A MEETING of the Executive Committee was held in the offices of the Hamilton Electric Light and Power Co. on May 10th

There were present Messrs. J. J. Wright, President, in the Chair; K. J. Dunstan, A. B. Smith, E. S. Edmonson, D. Thomson, T. H. Wadland, John Yule and the Secretary By invitation, Mr. George Black, of the G. N. W. Telegraph Co., was also present during a portion of the proceedings.

It was thought best in view of the fact that the management of the Industrial Exhibition are desirous of affording facilities for an electrical exhibit in Toronto next year, that no further action be taken towards holding an exhibition the present year, and was so decided.

The Secretary was instructed to correspond with the Secretary of the Hamilton Board of Trade to ascertain whether the Board would grant the Association the use of its rooms for the meetings in connection with the approaching Convention.

It was resolved that the Secretary should send a circular letter to the members of the Association, advising them of the date of the Convention, and instructing them when purchasing railway tickets for the Convention, to buy single ticket one way, and *ask the agent for delegate certificates which would entitle them* to reduced return fare.

The following persons were elected to active membership in the Association. W. J. Clarke, Bell Telephone Co., Toronto, W. B. Evans, Alex. Stark, Bell Telephone Co., Toronto; James P. McQuade, National Conduit Co., New York, A. T. Smith, Bell Telephone Co., Kingston, J. C. McLachlan, Bell Telephone Co., Hamilton, Samuel Gardiner, Electric Light and Power Co., Hamilton; Frank Badger, Royal Electric Co., Montreal; W. M. Goodwin, G.T.R., Hamilton; C. J. Leslie, Bell Telephone Co., St. Catharines, Samuel J. T. Brown, Bell Telephone Co., London, G. L. Shaeffer, Bell Telephone Co., Hamilton, George Black, G.N.W. Telegraph Co., Hamilton, G. C. Stannard, Construction and Electrical Supply Co., Toronto; W. G. Fraser, Bell Telephone Co., Petrolea.

The following persons were elected as Associate members: D. T. Symons, barrister, Toronto; Herbert Beaumont, Engineering Department Toronto Water Works; G. J. Kilpin, Toronto; T. J. Carroll, Brass Mfg. Co., Hamilton, K. Whipple, Hamilton, Geo. W. Sadler, Montreal; W. J. Duckworth, Toronto; W. T. Brown, W. T. Walker, Galt, T. G. Prouty, Electric Light Co., Bowmanville; W. J. Jones, Hamilton.

The President was deputed to secure a suitable design for a certificate of membership.

Messrs. Thomson, Walland and Dunstan were appointed a committee to endeavor to make arrangements for an excursion to and luncheon and band concert at Burlington Beach on the evening of Wednesday, June 15th.

The Toronto members of the Executive were authorized to choose a design for a members' badge and purchase the requisite number of badges. An outline of the order of proceedings of the Convention was decided upon as follows:

Tuesday, 14th. 11 a.m., meeting of the Executive. 2:30 p.m., Opening session. Election of officers. President's address. 8 p.m. Inspection of Electric Light Co.'s new station.

Wednesday, 15th. 10 a.m. to 12.30 p.m., reading of papers and discussions thereon. 2 to 5 p.m., visit to Bell Telephone Exchange. 7:30 p.m., trip by boat to Burlington Beach; luncheon at Ocean House.

Thursday, 16th. Reading of papers, discussion, business, etc. 2 p.m., Drive.

It was resolved on motion of Mr. Smith that the Hamilton members of the Executive associated with the Managers of the Great North Western Telegraph Co. and Bell Telephone Co., be a committee on invitations.

JAMES STREET NORTH, HAMILTON.

HAMILTON BAY.

REQUIREMENTS OF A PERFECT STEAM BOILER.

1. The best materials sanctioned by use, simple in construction, perfect in workmanship, durable in use, and not likely to require early repairs.

2. A mud drum to receive all impurities deposited from the water, in a place removed from the action of the fire.

3. A steam and water capacity sufficient to prevent any fluctuation in pressure or water level.

4. A large water surface for the disengagement of the steam from the water, in order to prevent foaming.

5. A constant and thorough circulation of water throughout the boiler, so as maintain all parts at one temperature.

6. The water-space divided into sections so arranged that should any section give out, no general explosion can occur, and the destructive effects will be confined to the simple escape of the contents; with large and free passages between the different sections, to equalize the water-line and pressure in all.

7. A great excess of strength over any legitimate strain, constructed so as not to be liable to be strained by unequal expansion, and no joints exposed to the direct action of the fire.

8. A combustion chamber so arranged that the combustion of the gases commenced in the furnace may be completed before their escape by the chimney.

9. The heating surface as nearly as possible, at right angles to the current of heated gases, so as to break up the currents and extract the entire available heat therefrom.

10. All parts readily accessible for cleaning and repairs. This is the greatest importance as regards safety and economy.

11. Proportioned to the work to be done, and capable of working to its full rated capacity with the highest economy.—*Steam.*

WORK AND POWER AS MEASURED BY THE STEAM ENGINE INDICATOR.*

(Continued from May Number.)

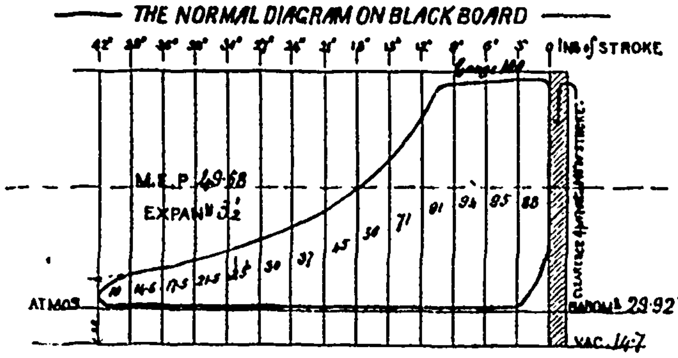
Of late years an instrument called the Planimeter has come into general use, for determining the M.E.P. of diagrams. In this form of it, it only gives the area of a diagram in square inches, and to the second decimal. Here its work ceases, and you must divide the area by the length—the quotient multiplied by the scale is the M.E.P. correct to the second decimal.

In Crosby's instrument, you set the instrument to the length of the diagram. After running the tracing point around the diagram, the reading of the wheel, if it began at 0, is the mean effective pressure to a scale of 40. If the scale is any other, then it is computed from 40. This instrument only goes to the first decimal.

The Coffin averager, has a moving pole. After going round the diagram and starting from the extreme right of the diagram, the tracing point is moved upward on a perpendicular line until the reading of the wheel is the same as at the beginning. The scale length from this point to the starting point, is the M.E.P. of the diagram. All of these instruments are expeditious in use and wonderfully correct, but their price puts them beyond the reach of a good many. I am acquainted with mechanical means for solving this same question, without making a figure or calculation of any kind mental or otherwise, that in quickness is away ahead of Amstler's Planimeter, and in accuracy superior I believe to the Coffin averager. If time permits, and you are not tired out before I get through, I will show you how it is done.

For illustrative purposes on this occasion a real diagram would be useless. You could not see it, and to overcome this I have laid out on the black board, an enlarged diagram, conforming in all respects, with the best performance of a first-class engine. There is no theory, guess, or dream about it. Any

THE NORMAL DIAGRAM ON BLACK BOARD



automatic engine with cylinder steam jacketed on barrel and ends, piston and valves steam-tight, all parts in proper proportion, and with boiler, steam pipe, stop valve and cylinder, in all of its parts, and outside of the steam jacket, completely protected from loss of heat, would produce, with an expansion of 3½ times, such a diagram as this. Of course our cylinder is 16" x 42", making 70 revolutions per minute, and a pressure by gauge of 100. On this large sized diagram I have used a scale of 4, or ¼ inch rise of the pencil per pound of pressure, and made it 42 inches long, the actual length of stroke, and I have divided it into 14 equal parts of 3 inches each, 14 being the first number above and including 10 that divides the length of stroke, without a fraction in the quotient. This makes it handy. By merely looking at the diagram, I can see that complete cut-off has taken place at 11 inches of the stroke, and that the exhaust port opened 3" previous to the end of stroke, and on the return stroke it closed at 3" previous to the end of the stroke, and followed by what is known as cushioning or compression.

On arrival at the end of the stroke the pressure due to compression has risen to 22 lbs. above atmospheric pressure, when it is evident that the steam valve has opened the passage, and the pressure jumps up to 98.

At this point the stroke from that end of the cylinder begins, the port is kept open, and in fact the opening is gradually increasing in area until in this case at 9½ inches of the stroke tripping or disengagement takes place, and at 11 inches of the stroke the valve has completely closed the communication with the boiler, and expansion of the steam then imprisoned in the cylinder follows. At the 39th inch of the strike, the exhaust port opens, a sudden drop of pressure takes place, and after the piston has finished the stroke, and is fairly started on its journey back, it sobers down to a uniform back or exhaust pressure of 1½ lbs. to the square inch, until cushioning is again set up—and so on, as long as the engine is working.

I will now measure this diagram in order to find the mean effective pressure. I have already done it with my foot rule, in order to save your time, in sitting looking at me while doing it, and the number of ¼ in. in the mean height of each 3" division, I found as follows: 88, 95, 94, 91, 71, 56, 45, 37, 30, 25, 21½, 17½, 14½ and 10. These amounts added together, give a total of 695½, which divided by 14 (the number of equal parts that the diagram is divided into), gives a quotient, 49.68, of which is the M.E.P. in pounds per square inch of this particular diagram on a scale of 4, and here our power constant of 3 comes in. This M.E.P. of 49.68 multiplied by 3 gives us 149 HP. being the rate of work done by our 16" x 42" engine under conditions as per diagram.

As we all know, this means that a constant pressure of 49.68 lbs. per square inch, acting on the face of the piston during the whole stroke, would do the same amount of work done by the varying pressures in the diagram.

At this point an important question arises that I have often heard asked by young engineers and by old ones too for that part, and likely the same query has arisen in some form or another in the mind of nearly every person present.

The work done by the varying pressures in that diagram ranging from 95 to 10 is equivalent to a uniform pressure during the whole stroke, of 49.68, or say 50 in round numbers—why would it not be as effective and economical to use a plain slide valve engine, without lap, and carry a uniform pressure of 50 lbs. during the whole stroke, and do away with all the whim whams and gimcracks of dashpots, springs, weights, trip gear, multiplicity of valves, and so on?

This is an honest straightforward question, and is entitled to a direct answer. In conjunction with the diagram, we are indebted to a Frenchman, Henry Victor Regnault for a direct, easy and true solution of this very important question. Between 1845 and 1850 he was instructed by the French government to make investigations and establish numerical data bearing on calculations connected with the working of steam engines. Regnault was well adapted for such work. He was a professional chemist and experimentalist, and had the mechanical ability for contriving means for the solution of such questions. After several years close application he finished the work; and the French Government with that liberality so characteristic of it in scientific affairs, gave the results to the world free.

As I stated before, the piston and cylinder of an engine at work, in reality perform the functions of a meter. Every stroke she discharges a uniform volume of steam, which volume is equal to the piston displacement during a stroke, and the pressure at which discharge or exhaust takes place is measured on the diagram, and in all cases must be measured from a perfect vacuum, which by common consent is 14¾ lbs. below the atmospheric line on the diagram. If great accuracy is required then the true position of the vacuum line is obtained from the height of the barometer when the diagram was taken.

And now when these preliminaries are through with, I will answer the previous question. By a former calculation I found that the piston displacement or displacement constant of our 16 x 42 inch engine, making 70 revs. per min. was 41050 cubic feet per hour, and this is also the volume of steam discharged in that time. Next I measure the terminal pressure of the expansion or automatic diagram, and find it to be 28 lbs. I next refer to Regnault's tables, and find that 14.37 cubic feet of steam at a total pressure of 28 lbs. per square inch weighs one pound. Here is what we are looking for. The total volume of steam per hour, 41050 cubic feet, divided by 14.37 the number of cubic feet in a pound, gives for answer 2856 pounds of water in the form of steam as having passed through the cylinder in one hour as accounted for by the indicator. But our engine has worked during that time at the rate of 149 HP. Dividing 2856 by 149, we get 19.15 pounds of steam accounted for by diagram, per HP. per hour. So far I have paid no attention to cylinder clearance; it is down on the diagram as 4 per cent. or 1.25 part of the stroke. Leaving cushioning out of the question this will have the effect of adding 1.25 or 4 per cent. to 19.15, bringing it very close to 20, which amount I accept as the water equivalent of our diagram per HP. per hour.

We will now take up the case of the M.E.P. being carried the whole stroke, and see what the results are, the piston displacement being the same. The terminal pressure must be measured from a vacuum, and in this case it is 49.68 x 14.7, or a little over 64 lbs. according to Regnault's tables 6.6 cubic feet of steam at a total pressure of 64 lbs. weigh one pound. As before dividing the constant 41050 by 6.6 we get for answer 6220 pounds of steam passing through the cylinder per hour, and delivering 149 H.P., the same rate as in the expansion engine. Dividing 6220 by 149 as before, we get a rate of 41.7 lbs of steam per HP., per hour, accounted for by the indicator, to which we add as in the first case 4 per cent. for clearance, we finally get 43 lbs. which is the water equivalent of our non-expansive engine, per H.P. per hour. For every 20 lbs. of steam discharged by the automatic engine 43 is discharged by the non-expansive engine in delivering 149 HP., with the necessary consequence that more than twice as much fuel is burnt on the grate to generate 43. lbs of steam, than it takes to generate 20.

It is in this manner that the economical performance of engines are compared—slide valve, automatic, condensing, non-condensing or compound, are all subject to one general principle rule or law, that the lower the terminal pressure of a diagram is, relative to the M.E.P., the greater is the economy of the engine. This is a truth common to all engines, yet it has a limit, steam obeys laws in expansion, and if the pressure falls below the amount due to that grade of expansion, it is proof of loss, either by condensation or leakage. A performance in

* Paper read at a recent meeting of Montreal Branch No. 1, C. A. S. E.

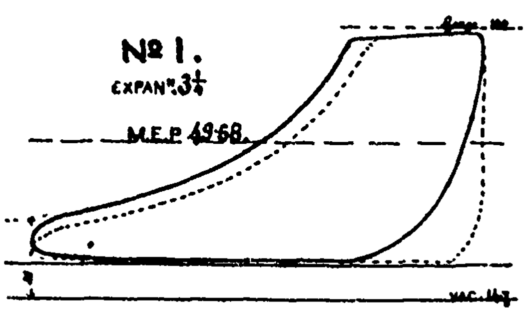
apparent defiance of all rule and decency, is the behaviour of a non condensing engine when loaded very, very light, and the expansion curve drops below the atmospheric line. This is the most pernicious evil that can afflict an engine. I know an automatic engine in this city, and a good one, too, that owing to light loading, the indicator accounts, for a consumption of from 75 to 80 lbs of water, per HP. per hour, a rate nearly twice as high as the ordinary slide valve engine, and on the other hand an automatic engine overloaded and going so slow that she does not trip, degenerates at once to a common slide valve engine of a very poor class. This shows the importance of an engine being sized to fit the amount of work she is expected to do.

It is best for an engineer to train himself to the idea, that work on an indicator diagram is represented by a space of two dimensions, or an area, which it really is. The planimeter measures the area in square inches, and by a subsequent process the M. E. P. is obtained. The same thing is done, by ordinating, it is really measuring the mean height by the scale of the spring used. Any increase or decrease of the area of diagram, is accompanied with a corresponding increase or decrease of the work done. When this idea is mastered, it is surprising what results it leads to, and what an advantage it gives us in matters connected with engines, that are otherwise very obscure. Take our 16" engine; this diagram fairly cuts off at quarter stroke. Now it so happens that the scale line representing the M.E.P. fairly divides into two equal parts the space contained in the rectangle, bounded by the atmospheric line, the line of boiler pressure, and the two ordinates bounding the length of the diagram. It is evident then, that the space in the rectangle which is outside of the diagram, is equal to the area of the diagram. Now, dropping the niceties of the question, we see at once that if we carry steam full stroke and maintain a speed of 70 we double the work done at an expenditure of nearly 4 times the weight of steam. In engineering inquiries of this sort it is necessary in the first place to proceed on the assumption that no losses or resistance of any kind take place, afterwards these losses and resistances are determined and subtracted.

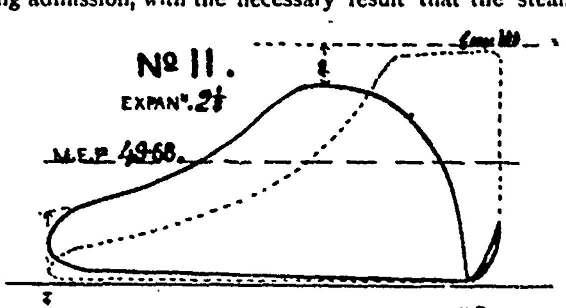
From actual diagrams taken in this city from automatic engines, carrying steam to nearly full stroke, the losses due to drop of pressure between boiler and cylinder, the fact that the admission port was closed before the end of the stroke and a slight expansion took place, the behaviour of the steam during exhaust with the consequent high back pressure during the return stroke, and the necessary loss of speed in the engine to cause non-tripping, amounted to 30 per cent. This brings our engine down to 208 HP. when carrying steam to the greatest possible extent and making 64 revolutions per minute and with boiler pressure of 100 lbs.—only a gain of 59 H.P. above that obtained when cutting off at quarter stroke.

I have examined this diagram on the black board, and find that the economical range of our 16" engine with 100 in boiler is from 70 to 170 HP. Above 170 HP., the weight of steam used is beyond all proportion to the work done, and below 70 H.P. other causes set in that would ruin the performance at once.

Some engineers have a strange habit of attempting to govern the engine themselves. I have observed that they never have

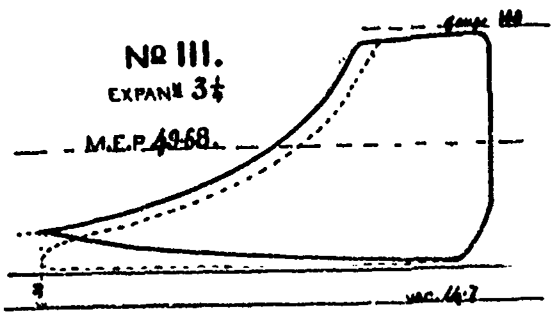


the throttle valve wide open, and from some cause that I could not perceive, they were continually turning the hand wheel a little inwards or outwards. What is the result? By obstructing the free flow of steam to the cylinder you lower the pressure during admission, with the necessary result that the steam is

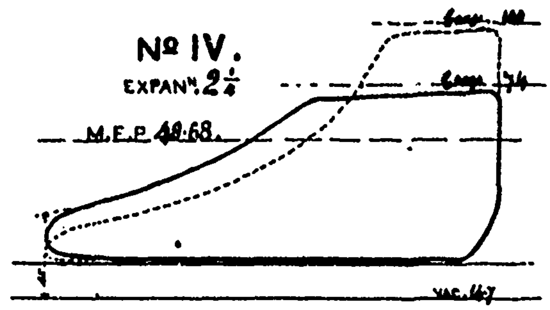


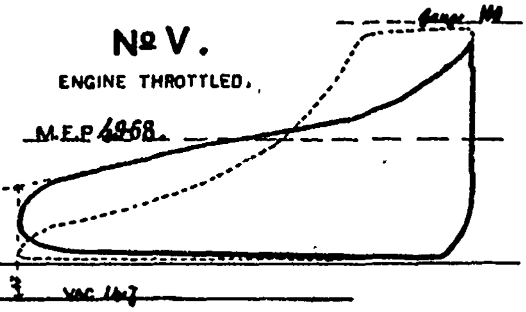
carried further in the stroke, and the stroke is finished with a higher terminal pressure a loss that can be made out in dollars and cents if required.

The immediate effect of all defects in valve gear, such as admission of steam too early or too late, or lateness of exhaust and consequent high back pressure, or excessive cushioning is a reduction in area of the diagram, which means a reduced M.E.P. and a consequent slowing of the engine; then the weights of the

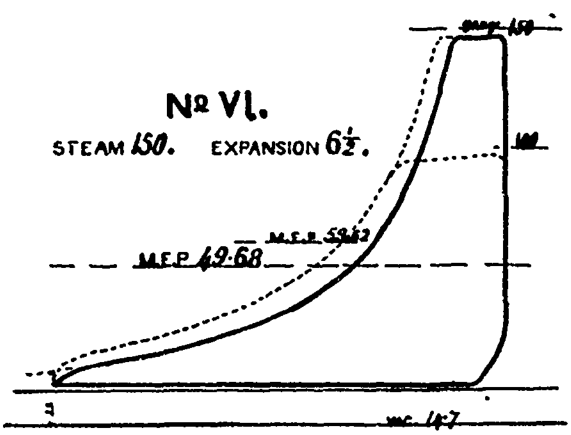


governor take a lower position, and steam is carried further in the stroke, with the necessary result that the terminal pressure is raised, or in other words, a greater weight of steam is used per stroke.





It is said that high pressures are conducive to economy. This is doubly true, but how does it arise? The scientific man explains it by the increased heat energy of the steam which is got so cheaply. The indicator gives the cause in a graphic manner that we can understand. Referring to our diagram on the black board: steam in boiler 100; cut-off quarter stroke, actual expansion 3½ times; terminal pressure 28 lbs.; M.E.P. 49.68; H.P. 149. Suppose we have steam in boiler at 150 by



gauge, this has the effect of raising the steam line on our diagram 12½ inches higher, on a scale of ¼ inch to the pound. There we have it at sight. The increased work done, is in proportion to the additional area inclosed, relative to the original diagram; and mark this, the expansion line in the added part is an extension of the original, and the stroke would be finished with a higher M.E.P., but the terminal pressure remains the same—28 lbs.—and there is no extra weight of steam in the cylinder.

But in this case we only require a M.E.P. of 49.68 lbs. to deliver 149 HP. The forces now acting on the engine are not in balance, and she starts off at a quicker speed; the governor weights fly out, cut-off takes place earlier in the stroke, and the consequence is, that another expansion curve is described by the indicator, below the original, and the stroke is finished at a lower terminal pressure, or with a less weight of steam in the cylinder, and hence the economy of high pressure steam, which in this case can be computed from either end of the diagram—on the steam end, from the decrease of the period of admission, and on the exhaust end, from the lowering of the terminal.

When I commenced to write this paper it was my intention to examine in detail a subject of importance in steam engineering that in a mysterious manner affects the economical working of engines. But I found that the limit of time allowed to the reading of a paper would be exceeded, and I abandoned it. But when I saw in your advertisement of this meeting, that a cordial invitation to attend was given to manufacturers, I thought it best before closing to call attention to it, because it is to them that we must look for the means of removing or reducing the loss.

The subject is complicated, but understood by those engineers that have turned their attention to it and verified their observations by the indicator, a foot rule and a platform scale. You will remember that in ascertaining the comparative economy between an expansion and a non-expansion engine, after arriving at the figures 20 and 43, I suddenly dropped it. All right so far, but that is not the end of it.

It is a fact that when tests are carried out as they should be, the difference between the steam or water accounted for by the indicator and the actual water fed to the boiler, is generally enormous. It may then reasonably be asked, what is the value of indicator deductions when such a difference exists in the actual quantity fed and weighed or measured in front of the boiler?

The indicator puts a numerical value on the loss. It is the duty of the engineer to discover the cause or causes, and remove them if possible, subject to the contingency that his employer is willing to furnish the means. A case took place in this city about a year and a half ago, the details of which came under my observation. A contracting engineer offered to make certain changes in an engine which would cost him several thousand dollars, and accept in payment the saving in fuel effected for a period of 425 day's work, say one year and a quarter. The proposal was accepted. This matter, of course, was talked about. The contractor was laughed, at men paid salaries of thousands a year expressed unfavorable opinions, and one of them, apparently in seriousness, asked me if I did not think that softening of the brain was a factor in the transaction.

But the contracting engineer was right, he did his work, and was well paid. What he did (divested of all obscurity) was to increase the ratio of expansion, decrease the amount of water which disappeared from the boiler and was not accounted for by the indicator as elastic and working steam in the cylinder, and add a condenser, effecting a saving in fuel alone of over $6,000 per year on a basis of 300 horse-power.

It would require a lengthy paper to do justice to the subject of the difference between the weight of steam accounted for by the indicator and the water fed to the boiler, but I will state some of the general results that have been observed. With a boiler of good steaming qualities, ample steam room and water surface, but unprotected from loss of heat, and steam pipe and cylinder perfectly naked, the indicator accounts for about one-half of the water fed to boiler, say 5 lbs in 10 feet. With boiler and steam pipe fairly well protected and barrel of cylinder cased in strips of wood only, 6½ lbs. is accounted for in 10 fed. With boiler and steam pipe clad in a superior manner and cylinder completely protected from loss of heat, both barrel and covers, and nothing exposed but the piston rod, from 8 to 8½ lbs. are accounted for per 10 fed. These are general results in ordinary practice; anything better is obtained by the use of a steam jacket and slightly superheated steam.

I have lately read a report of some tests of engines made by Prof. Thurston; however, nothing was done to get the weight of water fed to boilers. But in his report he added 30 per cent. to weight accounted for by indicator; this is equivalent to 7.7 lbs. accounted for per 10 lbs. fed. If we add 30 per cent. to the 20 and 43 lbs. found in our 16" engine when working at 149 H. P., we get 26 and 56, amounts that in practice will be found close. And with a boiler efficiency of 8 lbs. of water evaporated per lb. of coal burned on the grate, we obtain the following final result: Automatic engine, 3½ expansions, 3¼ lbs. of coal per H.P. per hour, non-expansive engine, 7 pounds of coal per H.P. per hour.

PUMP NOTES.

In inserting a pump of any kind, every joint should be well wiped before putting together, in order to prevent dirt being between the compacting surface and hence impairing the tightness of the joints. All bolts and screws should be well oiled, or better yet, wiped with black lead and grease, before putting in Then when the time comes for them to be backed out this can be done. For a similar reason, flange joints that are put together without rubber gaskets should be smeared with black lead and grease. Where rubber gaskets are used, one side, and one side only, should be rubbed with dry black lead, or with chalk, so that when the time comes to break the joint, the gasket will come off, entirely upon one flange, not part of it upon one and part on the other.

When a steam pump has been set up, the first thing done should be to blow steam though the steam end to see that all joints are tight and everything free that should be free. Blowing through to remove dirt should be done with the bonnets off if that can be done. Then the water side should be primed to see whether or not it is tight on the suction side. There should of course be a foot valve; and if there is any leak in the pipe or at th valve, that will be very readily detected in a short time. The suction valves should be tight under pressure of the full head of water that can be put upon them, so should the discharge valves; and these two sets can be tested after the foot valve is proved.

When all is connected properly, and shown to be, or made, tight, then the pump should be started up slowly under steam, if it is a steam pump; and work gradually put upon it until it is doing full duty. It should be tested to a pressure and speed beyond that which will be required of it in its daily work.

A pump which is to be kept for a fire service only should be tested very often to see that every thing about it is in first class order and ready to go to work at five seconds' notice. "Very often" means not less than once a week. Fire pumps should have right at hand, everything that is needed to start them up, or to adjust them. Throttle valves or discharge valves should have wheels or levers which cannot be removed, and all spanners or other things of that nature should be tied or chained in place, so that when wanted they will be right at hand and usable at once.

If a pump refuses to lift its water there may be any one of several things the matter with it. It may have a leaky suction pipe, or a leaky piston or plunger, or a leaky stuffing box, or a cocked valve, or one which is stuck shut; or the gaskets may be rotten; or if it is a new pump there may be somewhere a "blind joint" through which no water may pass. There may be a pocket of air in some hump in the suction pipe; the suction pipe may not have been primed; or the priming water may have leaked out by reason of a leaky suction pipe or of deficient foot valve.

Sometimes a pump will not start off well, even when the suction side is all right; this may be by reason of its being "air bound;" acondition of affairs that is very often remediable at once by opening a pet cock between the discharge valves and the air chamber. Sometimes indeed a pump may fail to pick up its water by reason of its being air bound on the discharge side.)

Some times a pump which does not draft well to start with may be made to catch its water by running it very fast so as not to give time enough for air to leak in, to spoil the suction. When it has got its water, it may keep on drawing well, although its capacity and its quietness of running, will be lessened by the influx of air with the suction water.

Special care should be taken with direct acting steam pumps not to let them suck wind, because if they do, there is liability of our knocking out a head.

Where there is liability of freezing, it is not safe to have a foot valve which can not be tripped so as to entirely clear the suction line ;and there should be a "bleeder" by which the pump itself may be drained thoroughly. Where the suction pipe is drained to prevent freezing, there should be extra facilities for priming; and of course if the pump is for fire service that is especially the case; for it may not do to have the water stand in it, and yet it must be brought right up to working capacity in a very short time; and if it will not draft its water without priming, it must be primed at once by sufficient flow of water to prevent the object of priming being defeated by leakage.

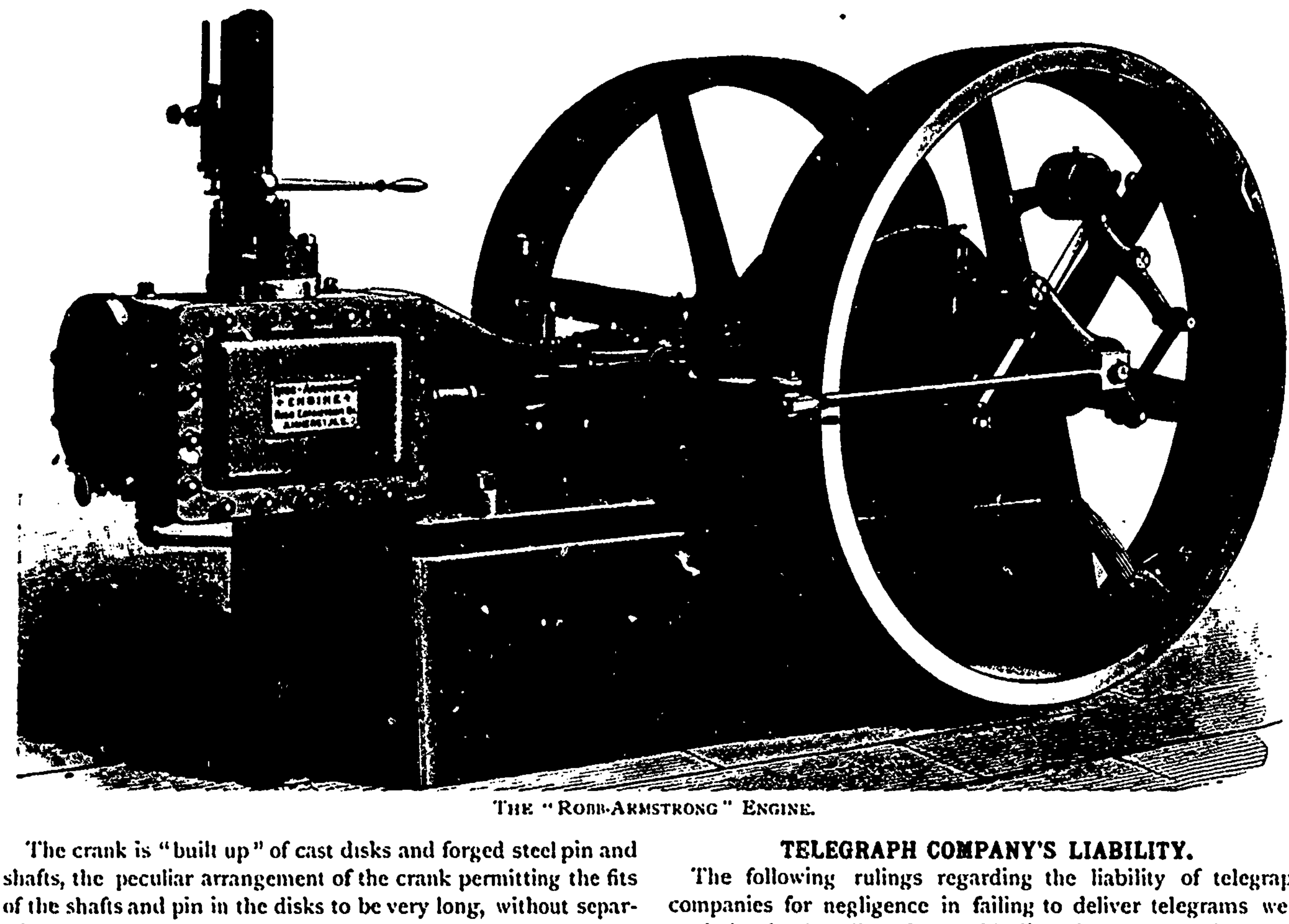
Pump buyers are not sufficiently careful or well posted in choosing; they will buy a centrifugal pump for service where a piston pump is needed; will put a pump that has small poppet valves, closed by springs, at work pumping material that is full of stringy solids; will buy a small fire pump for boiler feeding purposes, or set a brass pump to work on ammoniacal liquor, and so on. In ordering or in getting quotations, the pump buyer should state what the pump is to be used for; if for more than one purpose, both or all should be stated; the steam pressure available should be given; and if this is likely to fall that fact should be stated also. The liquid to be pumped should be described; whether clean or greasy, fresh, salt, alkaline, acid, muddy, full of bark and vegetable matter, or what; and its temperature should be stated; because some materials thicken up at low temperatures where they have to be drafted. The maximum amount that will be called for per hour, and the minimum amount that can be got along with, should be laid down; and the pump maker or dealer should be told whether that amount must be delivered regularly, or whether it will do to run double speed or capacity for a while and stop the rest of the time. The maximum distance that the liquid must be drafted, the length, diameter and material of the suction pipe, and the number of bends, should be given. Then there should also be stated the maximum height to which the liquid is to be pumped, the length, diameter and material of the discharge pipe, and the number of ells or turns.—*Power and Transmission.*

Messrs. John Starr, Son & Co., of Halifax, in an advertisement in this number call attention to their lines of electrical goods, especially to the "Samson" battery the rights for which they control both in Canada and the United States. The sales of these batteries last year are understood to have amounted to over 60,000 cells. Their "Unique" telephone is claimed to have the only transmitter which does not require readjusting and is not affected by atmospheric changes, jarring, etc. This firm erected last fall a line for the Valley Telephone Co. of Middleton, N. S., 20 miles long with thirteen instruments in series, the satisfactory working of which has decided the company to undertake the construction of a trunk line, 85 miles long throughout the Annapolis Valley with exchanges at the different towns through which it will pass. The whole line will be completed in July. Connection will shortly be made through to Halifax.

THE "ROBB-ARMSTRONG" ENGINE.

We illustrate on this page a new single-valve automatic engine recently brought out by the Robb Engineering Co., of Amherst, Nova Scotia. In general appearance it does not differ greatly from several popular high-speed engines, and no radical departure has been made in principles of construction, the aim being to combine as many as possible of those points which have proven best in practice, with such improvements in details as have been suggested by observation and experience with other engines. In other words, it is not an attempt to develop a new species, but to advance one step in the evolution of that already highly developed machine, the American high-speed engine. The following is a brief description of the main features :

The frame is of the "Porter" type with double-disk crank ; it has considerable sectional area, carried well above the center line, and is particularly thick at the top, thus bringing the metal in the direct line of strains between the cylinder and shaft bearings. The engine weighs a little over one hundred pounds per horse-power, not an unusual weight, but the metal is distributed to give the greatest attainable stiffness, and without much regard to the "anvil principle," the foundation being expected to furnish all the weight required in that direction at less cost.



THE "ROBB-ARMSTRONG" ENGINE.

The crank is "built up" of cast disks and forged steel pin and shafts, the peculiar arrangement of the crank permitting the fits of the shafts and pin in the disks to be very long, without separating the shaft bearings unduly, as is shown in the cross-section at the right of Fig. 2 ; the counter-weight is of equal moment with the reciprocating parts. The shaft bearings run in cast-iron shells, babbitted ; they are not provided with means of adjustment for wear. The bearings are finished by grinding operations of great delicacy, and are round and parallel within a limit of variation smaller than the average machinist will usually detect, even with the aid of the micrometer. The shafts are made to gauge, and the shells are interchangeable, as are the other parts of the engine ; hence, a duplicate set of shell may be kept for emergencies. The crank is covered by a cast iron case shutting it completely in except at the slot through which the connecting rod works. The crank disks are without the usual finished flanges on the periphery, the crank case being designed to have a substantial and finished appearance, and free access is given to the crank pin box, when the hinged crank case is raised. The crank-pin is oiled through two ½" holes, one extending from each side of the crank to the center of the crank-pin, all oil wasting from the inner ends of the shaft bearings being instantly carried to the crank, while all oil wasting from the outer ends of shaft bearings is caught, and by a ring riding on the top of shafts and dipping into the oil below, is returned again and again to the bearing, until it finds its way to the crank pin and escapes to the crank pit, to be drawn of and filtered. In practice the crank pin does not need oiling other than as stated, but a sight-feed oil cup is provided in addition to those oiling the shaft bearings, which will, if desired, feed oil direct to the crank-pin through one of the ½" holes before mentioned.

The fly wheel governor is a modification of the "Straight Line," and, together with the valve, is used by arrangement with the Straight Line Engine Co. ; the oiling devices mentioned will also be recognized as essentially "Straight Line."

The eccentric rod, so called, although there is no eccentric, has ball and socket bearings at each end, the balls being case hardened and ground, and the sockets or boxes of phosphor bronze. The rocker arm, by which the eccentric rod drives the valve, is horizontal, with a vertical axis ; there is no twisting strain on either of its bearings, a straight line passing through all three of them. An index finger attached to this arm, as shown in plan view, Fig. 3, shows, by the graduations over which it passes, the movement of the valve, and thus is of assistance in valve setting. *American Machinist.*

TELEGRAPH COMPANY'S LIABILITY.

The following rulings regarding the liability of telegraph companies for negligence in failing to deliver telegrams were made by the Appellate Court of Indiana in the case of Western Union Telegraph Company vs. Newhouse, viz. : That telegraph companies, while not strictly common carriers, and therefore not subject to the same severe rules of responsibility, yet are to be held to a high degree of diligence, skill and care, and are responsible for any negligence or unfaithfulness in the transmisson and delivery of messages, that ordinarily the specification in the address of a message of some place for delivery is by way of assistance in making a personal delivery, and the company is not necessarily absolved by such designation of place from making further effort to find the person addressed, and it may be negligence to fail to do so, that injury to the feelings occasioned by failure to deliver a message, unconnected with pecuniary loss or bodily injury, should be regarded as actual damage if the direct and proximate consequence of the negligence complained of, and that telegraph companies are liable for such negligence to the person to whom a message is addressed, as well as to the sender.

There are twenty-five telephones in use in the different establishments of the Rathbun Company at Deseronto, Ont. Over 80 electric wires converge to the general offices of the company.

PROPOSED BOARD OF ELECTRIC CONTROL.

FOLLOWING is the draft of a Bill to be submitted to the Dominion Parliament, reference to which is made in our editorial columns:

WHEREAS the use of electricity for power, heat and lighting, in all parts of the Dominion, is already common, is daily increasing and is likely to largely extend in the near future, and whereas in view of the dangers to life and property resulting from imperfections of design, defects in construction and imperfect insulation and maintenance of electric plant and installations are great, and whereas it is expedient that the power and intensity of the light supplied to the public by electricity for illuminating purposes, by municipalities, incorporated companies and individuals, and contracted for by meter or otherwise, should be subject to inspection and regulation in the common interest:—

THEREFORE, Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows —

1 The Governor in Council may appoint at such salaries as may be deemed proper, three persons, expert in the science, who shall be known as the Dominion Board of Electric Control, and who shall have the supervision of all plant and apparatus supplying or conveying electric energy throughout the *Dominion as hereinafter provided.*

2 Such Board may, in its official capacity administer oaths, issue subpoenas and employ such assistance as will enable it to carry out the provisions of this act.

3 Subject to the approval of the Governor in Council, the said Board shall draw up rules and regulations for the insulation of electrical conductors, the mode of erecting poles for carrying same, and the manner of placing the conductors thereon, the character and construction of underground subways, and the placing of electrical conductors underground generally; the construction and placing of converters or trans formers the relation between the various classes of conductors, carrying currents of different descriptions in the same city, town or village; the adoption and use of reasonable safety devices and appliances, and generally regulating the construction, maintenance and repair of the plant and apparatus of municipalities, companies or individuals engaged in the business of distributing electricity for commercial purposes throughout the Dominion, in so far as may be necessary to secure the *safety of the public as to life and property.*

4 The Board shall have power to devise and carry into effect, either independently or with the aid of the local authorities, in cities of over 25,000 inhabitants, plans for the removal of overhead electrical conductors.

5. The Board shall hold semi-annual examinations at two or more convenient points, whereat persons desiring employment as electricians, electrical experts, engineers or linemen, shall be examined and certificates granted to such as may be found to be duly qualified and to be fit and proper persons to be employed in the business of distributing electricity for commercial purposes, the examinations to be conducted and certificates granted under rules to be drawn up and approved, as in the case of stationary and marine steam engineers, with due penalties provided for the employment of unlicensed persons in cases where any electrical energy is sold or disposed of for hire, or any beneficial consideration whatever, or where conductors are used passing at all along public streets or highways.

6. The Board shall be empowered to examine into the circumstances of any death or accident to person or property, caused by electric currents, on giving the corporations or persons concerned, due and reasonable notice to appear and be heard.

7. The Board shall cause to be inspected at least semi-annually, all installations and plant generating and distributing electrical energy for hire, and shall issue certificates that the same conform to the standard of rules and regulations for the public safety.

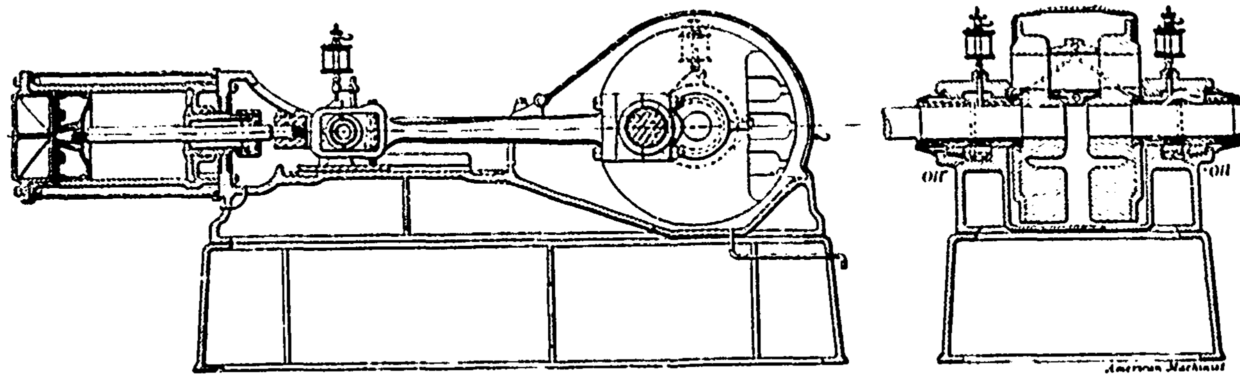
8. Any municipality, company or individual, supplying electrical energy for hire, or using electric conductors, passing at all along public highways or streets, without a certificate, as provided in section 7 hereof, shall be subject on proof, to a fine of $—— which may be recovered in any Court of competent Jurisdiction

9. The Board shall cause to be examined, all meters and devices for registering the quantity of electric energy supplied by municipalities, companies or individuals for hire, and certify the same to be accurate, the provisions for renewal, etc., to be based on the Dominion Acts regulating the inspection of gas meters.

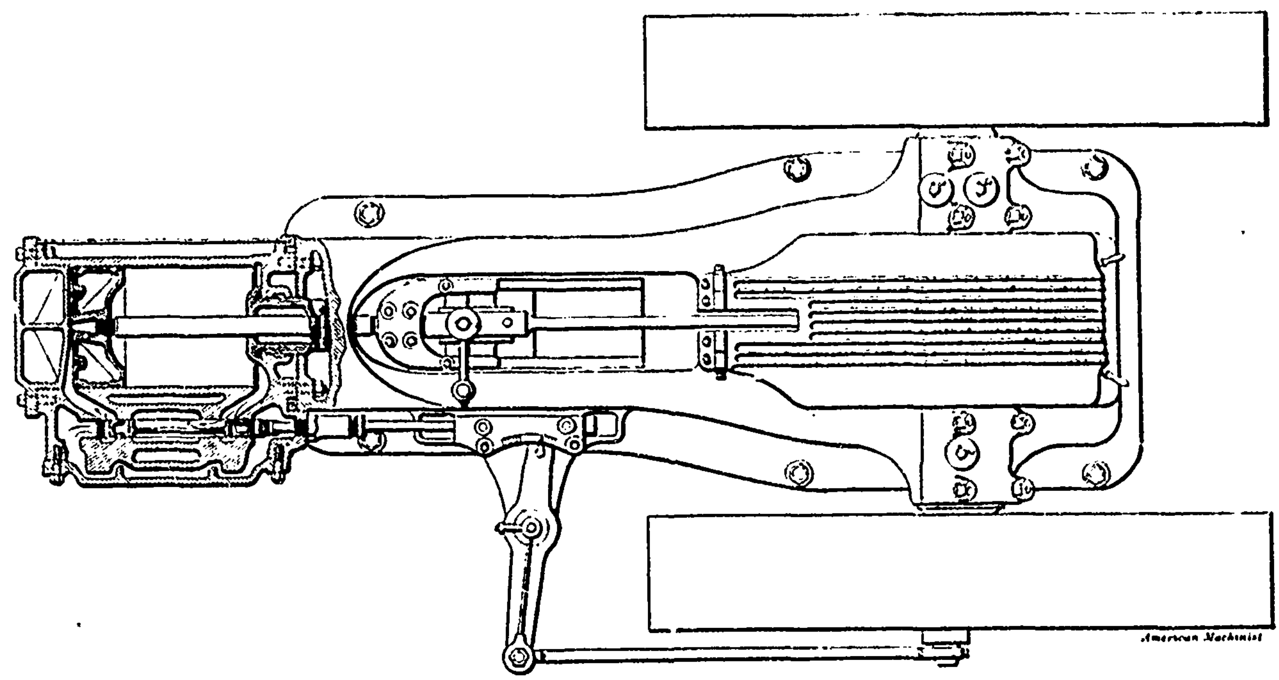
10. The Board shall provide for the periodic testing, in a proper and efficient manner, of the power and intensity of the light furnished by any municipality, company or individual for hire, or other consideration, and require the same to conform in every respect as regards illuminating power, to the standards laid down by Dominion laws for gas.

11. *The words "electricity" and "electric energy" shall be construed as including* all forms of electric or magnetic power or motion.

12. The annual expenses of the Board shall not exceed $——, and these expenses shall be borne and paid by the various companies engaged in the business of distributing electricity for commercial purposes within the Dominion, including all telephone and telegraph companies, companies distributing electricity for the purpose of furnishing heat, light and power, companies operating street cars or other public conveyances by means of electricity, district telegraph or messenger companies, and burglar alarm or fire alarm companies.



THE "ROBB-ARMSTRONG" ENGINE.—FIG. 2.



THE "ROBB-ARMSTRONG" ENGINE.—FIG. 3.

PUBLICATIONS.

The contents of the *Arena* for June embrace science, history, ethics, economics, politics, literary criticism, education, psychic science and fiction.

The Royal Electric Co., of Montreal, have issued an attractive book of *testimonials, in which is expressed the good opinion of their apparatus* entertained by customers who have had Royal plants in use for years.

We are indebted to the courtesy of the Secretary, Mr. Ralph W. Pope, for a copy of the transactions of the American Institute of Electrical Engineers from December, 1890, to December, 1891. The book, which is neatly enclosed in cloth covers, embraces nearly 700 pages, comprising papers and discussions on the important phases of electrical history and development. On the first page appears an excellent portrait of Prof Elihu Thomson, the fifth president of the Institute. There is also printed a full list of the members and associate members of the Institute. The book contains numerous illustrations, and forms a valuable work of reference.

Jas. A. Wright, formerly general manager of the Federal Telephone Company at Montreal, has left this company to fill a similar position with the Maxwell General Supply Company of Toronto.

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

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THE Order of Railroad Telegraphers, at its annual meeting in Chatanooga, Tenn., last month, resolved to hold next year's convention in Toronto, Ont.

IT was reported recently that a combination of the Westinghouse Co. and the firm of Siemens & Halske was about to be formed to oppose the Thomson-Houston-Edison concern. Messrs. Siemens & Halske deny however, that anything of the kind is in contemplation. Even in their separate capacity, the concerns mentioned should prove formidable competitors

THE mayor and a section of the Toronto City Council spent several months of valuable time and quite a sum of public money in finding out what everybody conversant with the subject knew beforehand, viz: that the overhead trolley is the only practicable method for the operation of electric street railways at the present time. Having at last made the discovery, the the Council has approved of the system, and the change to electricity will at once be proceeded with. It may be remarked in passing that the local storage battery company which announced its ability to do wonderful things, but neglected to give any practical proof of its *bona fides*, is now engaged in winding up its business.

THE amalgamation of the Edison General Electric Company and the Thomson-Houston Co. has been consummated. The officers of the new organization, which will be known as the General Electric Co., are as follows: President, Chas. A. Coffin, Boston, Mass.; first vice-president, Eugene Griffin, Boston, Mass; second vice-President, Samuel Insull, New York; Treasurer, A. S. Beves, New York; first assistant-treasurer, Gen. B. F. Peach, Jr., Boston, Mass.; second assistant-treasurer, W. F. Pope, Boston, Mass.; secretary, E. I. Garfield, Boston, Mass.; assistant-secretary, A. S. Beves, New York; comptroller, Jas. P. Ord, New York; auditor, Edward Clark, New York. The capital of the concern is $50,000,000.

WE have previously emphasized the fact that a most important part of the engineer's education in the future will relate to a knowledge of the principles of electric science and the construction and method of operating electric machines. In this opinion we are supported by *Electrical Enterprise* of Chicago, which says. "The rapid increase in the number of small isolated light stations is creating a demand for a class of skilled men of which the supply is very limited. We refer to engineers who are capable of taking charge of electric plants. The daily papers and technical press constantly contain advertisements asking for engineers with a knowledge of electricity. Here is a line of work that the trade schools of the country should give much more attention to. The demand is one that is constantly increasing, and an engineer with some practical knowledge of electrical machines is sure to find a ready demand for his services. The education of such men should be agitated much more than it is."

IF straws show which way the wind blows, and we believe it is generally conceded that they do, there can be no doubt but that in the patent recently granted to T. A. Edison by the U. S. Patent office, the Bell Telephone Co. will try to find an effective means of continuing the telephone monopoly in Yankee land for quite a number of years. Whether they will attempt this or not, remains to be seen, also whether they will make a success of it. We predict that the people would rise in their might, if such a thing were attempted. The Bell Telephone Co. may think discretion the better part of valor in this case, let well enough alone, and try to prevent competition on the expiration of their patents in 1893, by efficient service, at such prices as will pay their shareholders but a small interest on their investment. They have possession now, which in itself gives them a mighty advantage. By giving cheap rates and the best of service, they need fear no opposition. Here in this Canada of ours we are lucky in having our telephone service at a cheap rate, and as a general thing it is a good one. It would not pay an opposition telephone company to start business in Canada and expect to make money, for we know that the business throughout the Dominion is being conducted on a barely paying basis; nevertheless if the telephone patents were any good on this side of the line, things might be somewhat different.

As most of our readers are no doubt aware, the proposed consolidation of the Edison and Thomson-Houston Electric Companies in the U. S. has now become an established fact, under the name of the General Electric Co. It seems to us that since the names of Edison and Thomson have been associated with electric lighting almost from the start, it would have been better to have named the concern either the Edison-Thomson-Houston Co. or The Thomson-Houston-Edison Co. As it now stands, it will be necessary for the company's agents when trying to sell a plant to some party or parties who do not keep themselves posted in the concerns of electrical companies, to state the fact that they are selling T. H. or Edison apparatus, and just here we venture to say they will meet with individuals who will doubt their being in a position to supply such apparatus and who will still be on the look out for the Thomson-Houston or the Edison man to come along to sell them their desired machinery, whereas if they were representing a company whose name was that of the apparatus they were supplying, the agent, would have less trouble in selling his wares. There can be no doubt, however, that the ultimate object of The General Electric Co. will be to absorb all the other existing electrical manufacturing companies of any size and who might become active competitors. We have it from reliable authority that there will be no immediate change made in the affairs of either the Edison or T-H. companies in Canada, but that each will hoe its own row as heretofore.

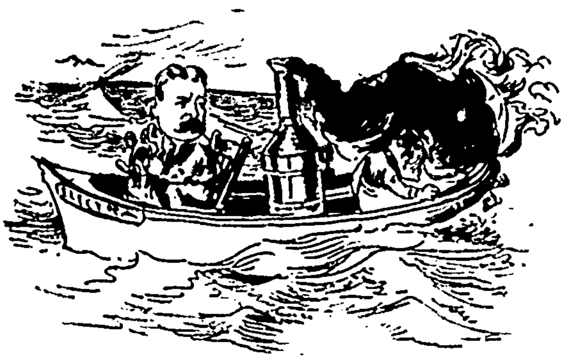
On another page will be found the text of a Bill proposed to be introduced in the Dominion Parliament with the alleged object of safeguarding in the public interest the conduct of electrical enterprises. The Bill provides for the appointment of three persons to act as a Board of Electric Control. This Board is to compel all persons engaging in electrical pursuits to undergo examination as to their efficiency; to inspect all electrical plant in use throughout the Dominion, and see that the same is of proper quality and rightly installed. The Bill provides that in cities with upwards of 25,000 population all wires must go underground. Finally it provides that the cost of all this "regulation" of the business shall be borne by the electric companies. The Bill, which is evidently inspired by some of the gas companies, is unjust, unworkable and unnecessary. The use of electricity in Canada has not been marked by many accidents nor given rise to much damage by fire. In Toronto, the accidents from this cause have been almost nil, while the total loss by fire traceable to electricity has been the sum of $8. With a record such as this in an electrical centre like Toronto, there is surely no cause for alarm for the public safety, or to saddle the electric companies with a burden of needless annoyance and expense. As regards the proposed Board of Control, it would be impossible for any three persons to perform the duties assigned to them by the Bill. The work would require the constant attention of more than half a dozen inspectors, and the cost, in a country of such wide extent, would be enormous. The inevitable result of imposing such expense on the electric companies would be to largely increase the cost to the purchasers of electric light, telegraph and telephone privileges, and to drive into bankruptcy many of the smaller electrical concerns. The Bill should receive the strongest possible opposition of all engaged in the electrical business as well as of purchasers of electric current.

We are in receipt of a letter from one of our subscribers in the far North West who suggests that it would perhaps benefit a number of our subscribers, were we to have a series of articles written giving practical directions for the construction of the different classes of dynamos in use at the present time. This would involve our writing a book, and could not be done in a series of articles without covering a long period of time, particularly as the ELECTRICAL NEWS is only published once a month. We therefore take pleasure in referring those who are desirous of becoming familiar with the different classes of dynamos and principles of their construction, to our editorial in this issue giving a list of books which teach these very subjects, and which, if followed out, will result beneficially to all who are seekers after this particular knowledge, and may be the means of giving them a more thorough insight into minor details that to a certain extent are surrounded by mystery to them at the present time. The same subscriber suggests that an article on house wiring might be beneficial to some of our readers, and as this is a subject that admits of an occasional article explaining the different methods and ways of doing incandescent wiring, we take pleasure in announcing that we will in the near future arrange for a series of articles on this subject, which we hope will be both beneficial to our subscribers, and ourselves—to our subscribers, or some of them, in the increased knowledge they will possess on this subject, and to ourselves in the increased number of subscribers our efforts in that direction may bring to us. It gives us much pleasure to be the recipient of communications from our subscribers similar to the one above, and it will always be our aim to enlighten them as much as possible on any subject they may suggest, for we know there must always be many others desirous of obtaining knowledge similar to that sought by the party who asks the question. We are pleased to see that the NEWS is thought of when perplexing questions relating to any electrical subject suggest themselves to our readers.

We are asked by some of our subsribers to give the names of books on electricity which would aid them in getting more of an insight and knowledge of the subject. While it is almost an impossibility for a person to become a thorough and practical electrician without that drilling which one gets in a large electrical manufacturing establishment or in a school where it is taught, yet we feel sure that if the course we point out here is followed with the earnest determination on the part of the student to learn as much as possible, and with a close devotion to the teaching of the different works here enumerated, it will at least start him on the right path. To those who desire to start at the A. B. C. of electricity we cannot recommend a better work than "The Elements of Electric Lighting," and "The Elements of Dynamic Electricity," both by Atkinson, containing as they do the preliminary knowledge necessary for a person who is desirous of advancing in the science. After this has been mastered then let the student take Prescott's "Dynamo Electricity," digest its contents, and make sure that its principal points are committed to memory. For the electric light man the next book in order, and one which will tell him what a dynamo is and how it is made, and why it performs its functions, will be Hering's "Dynamo Electric Machines." Just here we may say, that there is no better book published than this one for the use of the student and dynamo engineer; it gives in plain and untechnical terms and language what every man who has anything to do with dynamos should know; it describes in a thorough manner all the different forms of armatures, giving diagrams of the different windings, with explanation as to why they are wound so, nor does it neglect the fields, but shows in a practical and easily understood way what are the good points and what the bad about the different shapes and arrangements of fields and their windings. We therefore cannot commend it too highly to those who have sufficient preliminary knowledge to enable them to grasp its teaching. Plain language is used wherever possible and only in one small part are algebraic forms resorted to, and there they are an absolute necessity and cannot well be omitted. Its explanations are well worded and easily understood. We cannot, we think, conclude this article in a better way than by saying to those who desire to delve still deeper into the art, that Sylvanus P. Thompson's "Dynamo Electric Machinery" is the one book that an advanced student must make himself familiar with. True, it contains terms and language that cannot be understood by one who is just starting out in the study of electric lighting, yet there is a good part of it devoted to the practical, every-day explanation of the dynamo and its application in all its forms, and it is a well known fact that there is no other work published that practically explains the Thomson-Houston arc dynamo and its commutator and three coil armature better or more thoroughly. We hope we have mapped out a line of study in the above that will serve to guide those who are seekers after electrical knowledge, we might add that no matter who the man is, how much he may know, or think he knows, there is still room for more knowledge, and it should be every electrician's object to try and learn more and more every day about the science, by doing so he makes himself more valuable to his employer and betters his position in every way.

THE C. E. A. CONVENTION.

ON another page we print the programme for the first annual Convention of the Canadian Electrical Association to be held in Hamilton, on the 14th, 15th and 16th inst. The arrangements for this Convention are now almost complete, and are of a very satisfactory character. The programme, as will be seen, is a most interesting one; the papers to be read relate to almost every department of electrical work, and the authors are men whose long and varied experience should give to their opinions great importance. It is hoped that the discussion of these papers will be of the fullest possible character, and prove quite as interesting and instructive as the papers themselves.



THE PRESIDENT HEADING FOR HAMILTON.

The officers of the Association have devoted a great deal of attention to the arrangements for this meeting, and it now remains for the members to do their part, by making a point of being present at the Convention even if necessary at some personal sacrifice. Each one should come with the determination to do all that he can individually, to promote and secure the success of the meeting.

It is very desirable that every member should take part in the proceedings, and assist in stimulating discussion instead of leaving the business to be done by a few. If every member will come prepared to ask questions and impart such information as his experience may have afforded him, the occasion cannot be other than a profitable one to all who may attend.

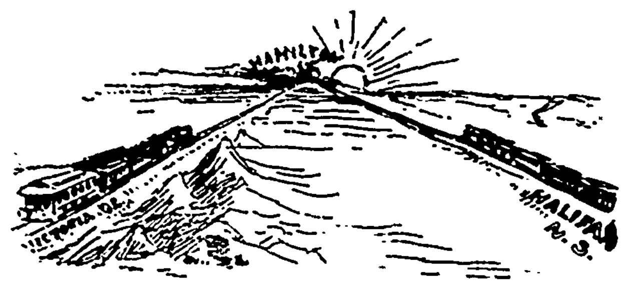
FOR THE EXCHANGE OF IDEAS, NOTHING CAN BEAT THE LONG-DISTANCE TELEPHONE—EXCEPT THE ELECTRICAL CONVENTION.

It is the desire of the president and officers that every thing should be done as informally as possible, that the fullest opportunity may be given for the members to become personally acquainted with each other, and that every body should feel free to take part in the proceedings, and share in the enjoyment of the social features of the occasion.

After having had communication on the subject with the manufacturers of electrical apparatus, the Executive of the Association have come to the conclusion that it would not be wise for the Association to attempt to hold an exhibition in connection with this first annual convention, but rather to devote their entire attention to placing the Association on as favorable a footing as possible.

"WHAT I KNOW ABOUT CONVENTIONS!"—J. CARROLL.

The management of the Toronto Industrial Exhibition have signified their desire that the Association should hold an exhibition in connection with the Industrial. In view of this it has been thought best to postpone any thing of this kind until the time of the Toronto Industrial Exhibition of 1893. By that time the membership it is hoped will have largely increased, the Association will have become in every way better established, and all the necessary facilities will be afforded for the holding of a creditable exhibition.



The growth of the Association, thus far, has been very satisfactory. It stands in a much better position than did the National Electric Light Association of the United States, at a similar period in its history. Its membership will soon have reached one hundred, and included in it are representatives of electrical interests residing as far east as Halifax, and west to Victoria B. C. That there is need for the existence of an Association of this kind, there can be no doubt. The electrical interests are growing at an exceedingly rapid rate, and it is only

THE VISITORS ARE ASKED TO BEHOLD THE MOUNTAIN!

by means of organization that the rights of these important interests can be conserved. There is at the present time, an attempt being made to secure the passage through Parliament, of a Bill, which would, to a great extent cripple the electrical business of the country. As soon as it became known that such a movement was on foot, the President of the Canadian Electrical Association caused a circular to be sent to all persons who would be affected by the proposed measure, calling their attention thereto, and urging them to take immediate action through their Parliamentary representatives and otherwise, to prevent the Bill from becoming law. Other circumstances of this nature will be certain to arise from time to time in the future, and it is in this direction that the Canadian Electrical Association should be able to do valuable service on behalf of the electrical interests. In view of its probable usefulness, it should receive the support of all engaged in electrical business.

Let by your objective point on the 14th inst., be the "Ambitious City."

QUESTIONS AND ANSWERS.

A CORRESPONDENT asks: (1) What am I to understand by the terms. 6, 8 or more ampere lights? (2) What is the meaning of candle powers such as 2000 nominal? (3) Does the number of ampere lights also constitute the intensity or strength of the lights, and what is the proportion how many amperes? -produces 2000 candle power; or how many for each ampere? (4) Would amperes produce the same strength of light with the machines of any of the leading manufacturers?

ANSWERS—(1). The number of amperes such as 6, 8, or 10, refer to the volume of current passing through the lamps. The light is about proportional to the current when the carbons are sufficiently far apart to work to the best advantage. (2). Nominal candle power is an indefinite term, the usually accepted standard being 6 ampere for a 1200 c. p.; 8 ampere for a 1500 c. p., 10 ampere for a 2000 c. p. (3-4). A current of electricity is the same thing, no matter how, or by what company produced. When measured on an independent standard instrument a 6, 8 or 10 ampere current would produce the same strength of light no matter who built the dynamo.

W. G. B. writes: I would like some information relating to the ringing on telephone lines. In a small place, with three or four lines and necessarily a central office, do they all ring on the one magneto, and how can the central answer, without calling on all the others? I can understand how to ring to the central, but the latter part is a mystery.

ANS. - Each subscriber to a central office has a line running from his instrument to an annunciator in central office. When the subscriber rings his bell the annunciator shows who has called. The operator switches his set of instruments on to that particular line, and rings or speaks as may be necessary.

C. A. S. E. EXAMINATIONS.

The annual meeting of the Board of Examiners of the Ontario Association of Stationery Engineers, was held in Hamilton a few days ago. The President, A. M. Wickens presided. The retiring members of the Board, whose term expired this year, were re-elected, except Mr. John Galt, of Toronto, who was replaced by Mr. J. G. Campbell, of Kingston, who, with Mr. Devlin, will be the members of the Board for eastern Ontario.

The following Hamilton engineers have passed their examinations in accordance with the Ontario Act: E. Johnson, W. Stevens, A. Marshall, A. Robb and R. Chilman.

Stewart & Harper, machinery brokers, Winnipeg, have leased the electric plant at Morden.

The question of superheated steam is treated in a very original manner in *Die Natur*, a German publication, a parallel being drawn between the action of a steam boiler and the eruption of a geyser. In the latter case, according to Bunsen, a cavern filled with water lies deep in the earth, under the geyser, and the water in this cavern is heated by the earth's internal heat far above 212°, since there is a heavy hydrostatic pressure upon it arising from the weight of water in the passage of natural stand pipe that leads from the subterranean chamber to the surface of the earth; after a certain time the temperature of the water below rises, so that steam is given off in spite of the pressure, and the column in the exit tube is gradually forced upward. The release of pressure and the disturbance of the water then cause the contents of the subterranean chamber to flash into steam and expel the contents of the exit pipe violently.

"NON-ARCING" METALS.

A discovery which promises to be of much practical importance in electrical work has been made by Mr. Alexander J. Wurts, and was described by him in a paper read March 15, before the American Institute of Electrical Engineers. In some experiments made in designing new forms of lightning arresters, a discharger was used consisting of three solid round brass rods, 1 in. in diameter and 1¼ ins. long, placed side by side with their axes parallel and air gaps of 1/16 in. between them. The line was connected to the two outside rods and the middle one was grounded. A piece of tinfoil was dropped in one of the air gaps to start the arc and a brilliant display of fireworks was expected. Instead of this a small spark no larger than a pea was the only result, and the arc was not maintained.

Mr. Wurts was inclined to ascribe this to the cooling effect of the metal dischargers upon the arc, and to test this theory determined to make much larger dischargers and also use a considerably larger current. The new dischargers were 2½ ins. diameter and 2 ins. long, and were connected to a 3,000-light, 1,000-volt alternating dynamo. When the current was turned on and the air space was bridged, the metal bars were melted like beeswax in a great ball of fire, much to the experimenter's disappointment. Thinking, however, that there could be no harm in melting up the small discharger, previously described, in the same way, he placed that in the circuit and closed the switch. To his great astonishment the small discharger remained intact, and the spark which passed was hardly larger than before.

It was then learned that the small discharger was of brass, composed of copper and zinc, while the large one, which melted so quickly, was a copper-tin bronze. Various other metals were then tested. It was found that steel, hard copper, phosphor-bronze, aluminum-bronze and aluminum, would all maintain a brilliant arc. Zinc was next tried, and with a discharger of this metal it was found exceedingly difficult to maintain an arc. This was especially surprising, for who is there at all familiar with the properties of zinc who would have suggested this metal as one likely to resist an electric arc of 1,000 volts in this manner? Tin and nickel were then tried, and the former gave the most brilliant arc of all the metals tested. Antimony was then tried, and notwithstanding its low melting point it gave no arc. The theory now advanced to explain the phenomena was that with the metals that do not allow the arc to be maintained, there is formed at the instant the arc is started, an oxide of the metal which, becoming instantly volatilized in the intense heat of the arc, chokes up the air-gap with vapors of high resistance, and presents an effective barrier to the further passage of the current. With metals that do maintain the arc, instead of the vapor of the oxide of the metal, there is formed a pure vapor of the metal itself, and this offers comparatively no resistance to the passage of the current. It will be noted that all the above tests were made with the alternating current. The direct current was next tested; and while an arc was formed with all the metals, it was very small and quiet with the zinc and the antimony.

A curious phenomenon connected with zinc and antimony is that there is less tendency to maintain the arc when the air-gap is small. Using an air-gap 2 ins. long and a 1,000-volt alternating current, the arc when once started will be maintained.. At ½ in. or ¼ in. the arc tends to maintain itself; but at 1/32 in. there is only a small spark and the circuit is instantly interrupted.

Further investigations were made to determine what other metals would act like zinc and antimony, and it was found that all available metals belonging to the same chemical group acted in the same way. Cadmium, magnesium, bismuth, and mercury in the form of a copper amalgam, were all tested with successful results,, the last named proving even better than the zinc or antimony.

The discovery has already been made use of by Mr. Wurts in the design of a special form of lightning arrester, composed of non-arcing metal. It seems likely to prove of practical importance in many forms of electrical apparatus.—*Engineering News.*

The largest power dam yet built in the United States will be that now in progress of construction across the Colorado River, at Austin, Tex. It will be, when completed, 1,150 feet long, 60 feet high, and 18 wide at the top. The up-stream face is of limestone, and is vertical, while the down stream face is of Texas granite, and the interior of rubble masonry of small stone and cement There will be about 9,000 cubic yards of granite, 6,800 cubic yards of limestone and 55,000 cubic yards of rubble in the dam. The dam is intended to utilize the power of the Colorado River for electric lighting, electric railways, pumping the city's water, and for factories, etc.

THE ELECTRIC TRANSMISSION OF POWER.*

By Gisbert Kapp.

(Continued from May Number.)

LECTURE III.

Owing to the low efficiency and small power of the two-wire revolving field motor, its employment is necessarily restricted to case where these defects are of little consequence, but for the transmission of large powers over long distance it is not suitable. For such a purpose we must have three wires, but this is not a great drawback since the cost of the line is but little increased by the necessity of splitting up the total weight of copper into three instead of into two wires. The revolving field motor has, however, the defect that it is not self-regulating. Its speed may be anything between zero and that speed which will give synchronism between the two machines accordingly as the mechanical load varies from a maximum to nothing. This defect can be overcome by combining with the armature in the motor a real magnet which will force the armature to keep step with the current, and thus insure a constant speed at varying loads. The motor will thus start with great power by virtue of the currents induced in the armature-winding by the revolving field, and having reached the synchronising speed it will keep there by virtue of the interaction between the revolving field and the revolving magnet; it will, in fact, behave just like an ordinary alternator run as a motor, with this difference, however, that the ordinary alternator, if overloaded by 50 or 100 per cent., will be thrown out of step and come to rest, whereas the combined Ferraris and synchronising motor will always be ready to recover itself after the overload has been removed.

Since the discovery of Ferraris has been made public, many engineers have turned their attention to revolving field motors, and especially to a modification of this principle, according to which three sets of coils are employed instead of two sets only. As far as I have been able to trace the history of this invention, the first to suggest the use of three coils were M. Tesla and Charles Bradley. The latter applied in the United States for a patent in 1888, which bears the number 406,450, and was granted on August 20, 1889. Next comes Wenstrom with his British patent, No. 5,423, of 1890, and at about the same time Dobrowolsky, in Berlin, had worked out a similar system. About a year ago, when I visited him at the works of the Berlin Electrical Company, he showed me such a three-wire motor in action, whilst shortly afterwards Charles Brown, of Oerlikon, took the

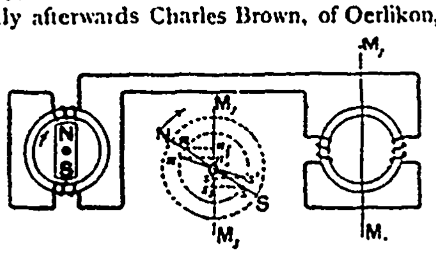


Fig. 13.

matter up, and it may interest you to learn that he is at the present moment putting up a 500 H. P. transmission plant on this system between Bülach and Oerlikon, a distance of 15 miles. This transmission is intended to supply all the power required in the Oerlikon Works. The general principle forming the base of the work done by these various inventors is illustrated in Fig. 13. The generator contains a revolving field magnet, and an armature wound with three distinct coils. The end, O, of each coil is joined to a wire, W, common to all, and the three free ends are joined with the three-line wires. At the receiving station there is a three-legged magnet, the coils on the legs being in connection with the line wires on the one side, and jointed by a common wire, W, on the other side. It is easy to see that the rotation of the field magnet in the generator will produce successive polarities in the legs of the receiving magnet, and that the general effect will be that of a revolving field. The armature, A, will, therefore, be set in rotation in the same way as is the case in the original Ferraris motor. This kind of transmission is known in Germany under the name of transmission by the "three phase current," and it is likely that it will, ere long, become a strong rival to the ordinary alternating current.

The diagrams I have brought before you were all drawn for two-pole machines, as this was the simplest way of making the principles clear; but I need hardly say that, in practice, the machines are made of the multipolar type, in order to bring the speeds down to any desired value.

You will, perhaps, ask why we should go to the complication of three-line wires and a totally new type of motor, seeing that, with the ordinary dynamos and motors, such excellent results have been obtained, and that with two-line wires. My answer is that, with this new system, we can greatly extend the distance of transmission. I have spoken, a short time ago, of the difficulties which the high voltage required in long-distance transmission raised in connection with the commutators and general insulation of machines. Now, in the three-wire system of transmission, by alternating currents, we have no commutators, and, in fact, not even rubbing currents. One of our difficulties, has, therefore, already vanished. As to the other, which has reference to the general insulation of the machines, it is easy to see how this may be overcome. We need only, instead of working direct, work through transformers. The insulation of transformers offers no difficulty whatever. I have here on the table a transformer of the type made by Messrs. Johnson and Phillipps, which has been designed specially for high-pressure currents, and is provided with oil insulation. I have recently used two of these transformers for testing a Brook's line. In one transformer the pressure was raised from 2,400 to 17,000 volts, the high pressure current was sent through the line, and, at the other end, it was again transformed down to 2,400 volts, and, finally to 100 volts, for lighting glow lamps. The apparatus was kept running for several days without any difficulty. Mr. Brown informs me that he has with oil insulators, even gone up to 36,000 volts without breaking down the insulation, and the Bulach-Oerlikon transmission will be made at 25,000 volts, whereas the machine will work only at a few hundred volts. There is thus no difficulty in adopting whatever voltage is most economical in each case, and yet avoiding all danger, either to the attendant or to the machines themselves, at the generating and motor station.

I feel that I owe an apology for having occupied so much of your time with discussing a branch of power transmission which, to many of you, must seem to be purely theoretical, and hardly ripe for discussion. My excuse must be that I am strongly convinced that some form of alternate current working will be the ultimate solution of the problem how to transmit power—possibly over all distances, but certainly over very long distances—and that I was desirous of directing the attention of electrical engineers to a subject in which much work may still be done.

ELECTRIC MACHINE TOOLS.

In concluding my lectures, I wish to bring before you a few examples of short distance transmission as applied to electric machine tools. This branch of our subject has of late years received considerable development at the hands of various English firms, and, thanks to their enterprise and perseverance, is now a well-established method in several engineering works.

As an example, I may mention the Leven Shipyard of Messrs. Denny Brothers, at Dumbarton, and Mr. Archibald Denny has been good enough to give me some particulars of the work carried on by his firm in this direction. I cannot do better than quote his words:—"In our yard and engine works we have numerous instances of electric transmission of power. In our experimental tank we drive our model cutting machine and small lathes by means of a 3 H.P. Immisch motor. In our upholstery department we drive six sewing-machines with a 2 H.P. Immisch motor; of course in this case there is a large margin of power. In our experimental tank we have also used small motors for driving small model paddle wheels in our experimental models, and have obtained in this way most valuable data, which we could not have got by any other means. The power for all this work is obtained from a dynamo driven by an ordinary line of shafting in our joiner's shop. We also use a 3 H. P. motor in the yard for boring the stern tubes in place; before this we used a portable engine, which necessitated an attendant to fire the boiler and carry water to it. During the holidays, when all the boilers are off except one, we occasionally put down a motor for driving some lathes to do repair work, and this saves an attendant at more than one boiler. In our engine works the the pattern shop is driven by a 15 H.P. Manchester motor, the dynamo being driven off the line of shafting in the fitting shop."

You see, Messrs. Denny Brothers find electric power transmission so handy, economical, and convenient, that they make extensive use of it. They employ a special tool for drilling the

*Cantor Lectures delivered before the Society of Arts, February and March, 1891.

sole plates of engines, which I now show on the screen. The weight of the machine is sufficient for the pressure required on the drill, and the whole apparatus being mounted on wheels it can be readily shifted. The machine will drill 1¼ in. holes through two thicknesses of inch plate in three minutes.

Another machine used at Leven Shipyard is a special drill for butt straps The motor and gear are mounted on a stout vertical column with horizontal arm, so as to give adjustment in both directions, the column being bolted to the strap, as shown. The machine will take in straps 50 in. deep by 23 in. between outer rows of holes, and is chiefly used for drilling sheer strake double but straps. The outside strap is first punched and countersunk, and the machine drills through the plate and inside strap. The machine is worked by two men one hole-borer and one laborer and will do three straps, or about 180 holes per day.

The rivet holes in boiler furnaces are also drilled by an electric tool, which I illustrate on the screen. The machine has a tripod stand arranged to go inside the furnace, but it has also holding-on magnets for outside work. One man with this machine does the work which formerly required three to four men.

No account of electric machine tools would be complete if it did not include the work done by Mr. Rowan, who has been very successful in developing this branch of power transmission. Amongst the improvements Mr. Rowan introduced is that of holding-on magnets, whereby the tools are firmly held in place while at work, and yet by the mere turning of a switch become liberated and can be shifted to a new position with the greatest ease. You see on the screen some of Mr. Rowland's drillers as applied to ship work. The apparatus is suspended on a chain over the ship's side, and supplied with current by means of two flexible wires. I need not detain you with a description of the picture on the screen because I can show you the actual machine at work, thanks to the kindness of Messrs. M'Whirter, Fergusson and Co., the makers, who have sent me one of their latest machines for this lecture.

I am also indebted to Mr. Webb, the locomotive superintendent of the London and North-Western Railway, for the loan of one of his electric tube cutters, which you see before you, and which I shall now work. A diagram of this machine to an enlarged scale is on the wall.

These few examples of what are properly called electric machine tools must suffice for this lecture, but there is another class of apparatus, namely, electric mining machines, which ought to be included in our subject. Several firms, both here and abroad, have of late years devoted considerable attention to the application of electric power to mining operations, such as pumping, hauling, coal-cutting, and drilling. Messrs. Goolden & Co., for instance have during the last four years steadily and perseveringly worked out many of the difficult problems in connection with this subject, and I am indebted to this firm for the loan of the apparatus you see here, and also to Mr. Atkinson for assisting me in setting the machines up. After the excellent Paper which Mr. Atkinson read at the Institution of Civil Engineers, only a few weeks ago, it would be occupying your time uselessly if I were to give any lengthy description of these machines. I shall, therefore, merely show two types of mining motor on the screen, and show a drill at work.

I have in these lectures not attempted to treat exhaustively any one branch of the subject, but have rather endeavored to pass the various branches in rapid review, so that you may know what electric transmission of power can do and what it cannot do. We hear now-a-days very frequently the assertion that electricity is but in its infancy and will ere long be the sole motive power, driving our main-line trains, speed our vessels across the ocean, and running our factories. These are idle dreams, ideas put forward by persons who have forgotten, or have never learned the fundamental laws of nature. Do not waste time over such ideas, for there are other more hopeful problems, such as the utilization of water power generally, of waste coal at the pit's mouth, the working of railways in mountainous districts, where water-power is abundant all along the line, the working of tramways, underground town railways, the application of electric power to such purposes for which now small auxiliary steam engines are employed, and last, but not least, its application to machine tools and other special machinery, of which I have given you examples to-night.

SAFTEY VALVES THEIR HISTORY, ANTECEDENTS, INVENTION AND CALCULATION.

By William Barnet Le Van.

(Continued from May Number.)

One form of annular valve is shown in Fig. 49, the external diameter being 4 inches; internal diameter, 3.25 inches. The steam passes outside of, and through, the valve to the atmosphere.

The valve shown in Fig. 50 has proved a very efficient safety valve. Steam is discharged at the outer edge of the valve and through apertures in

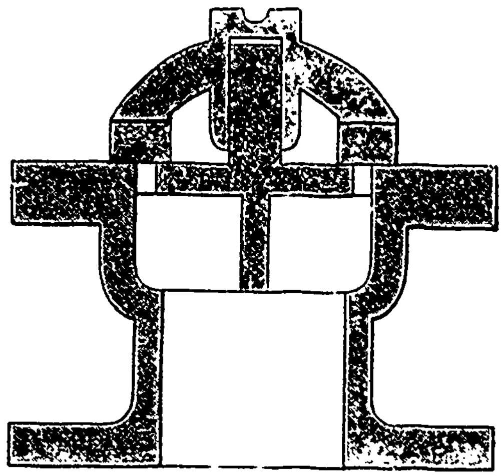


Fig. 49.—Annular Safety Valve.

the valve itself. The valve is guided to its sit by means of a central spindle extending below its sit. The principle of annular safety valves is not new.

Double-Sit Safety Valves.

These valves are constructed with two openings of unequal areas for the escape of the steam. The valves are attached to the same spindle, and the pressure, acting upon the one with the larger area, tends to force it *from* its sit; the pressure acting upon the one with the small area, tends to force it *to* its sit. The extra force applied to prevent the valve from opening is just sufficient to balance the difference between the two areas.

The inventor of this safety valve claims simplicity of arrangement of parts; that it will relieve a boiler of all excess of pressure quicker and more

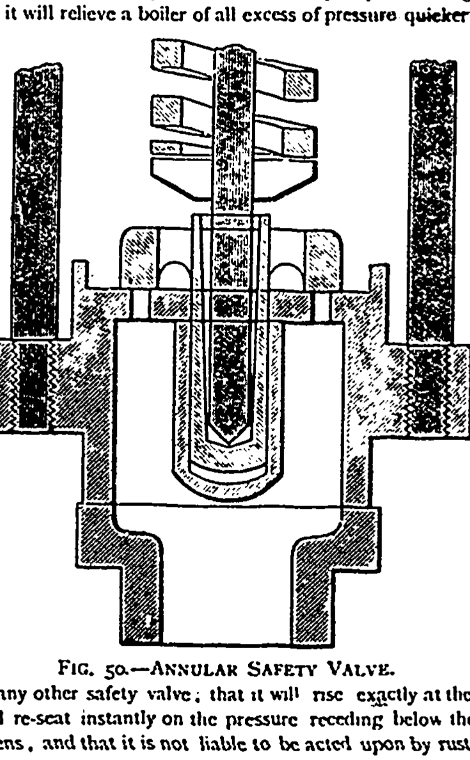


Fig. 50.—Annular Safety Valve.

freely than any other safety valve; that it will rise exactly at the pressure desired, and re-seat instantly on the pressure receding below the point at which it opens, and that it is not liable to be acted upon by rust and dirt from a boiler.

The *ratio* of the difference between the areas of the two openings is so arranged that, by the addition of one pound weight to the valve stem, one pound additional pressure per square inch will be necessary to open it.

On a test made of this valve, the claims of the inventor were not sustained. It is doubtful if *double-seated valves* will ever be made to answer the purpose intended.

Piston Safety Valves.

Piston valves are operated by the pressure of the steam acting against the end of a piston fitted to a cylinder, forcing it outwards, and uncovering gradually the opening of the valve.

The one great objection to the use of piston valves, namely, that they are likely to become clogged by the accretion of matter around them (unless in constant operation), as to prevent them operating until a large excess of pressure is attained, militates against their general use. There is no doubt that in this form of valve a much larger effective area can be obtained than with the common lever valve, and one with a smaller diameter may be employed.

The piston of the valve shown in Fig. 52 is of a larger area than that of the valve proper, and is located some distance below the valve sit, and attached to the valve by means of a spindle extending downwards. Between the piston and the valve proper is a space which may be called a reduction chamber. The steam is admitted into this chamber through apertures in the surrounding casing just above the top of the piston, and when the pressure exceeds the resistance of the weight on the valve proper, and lifts it from its sit, it brings up with it this piston. The apertures in the casing are, by this action of the valve, partially closed by the piston, and the steam is

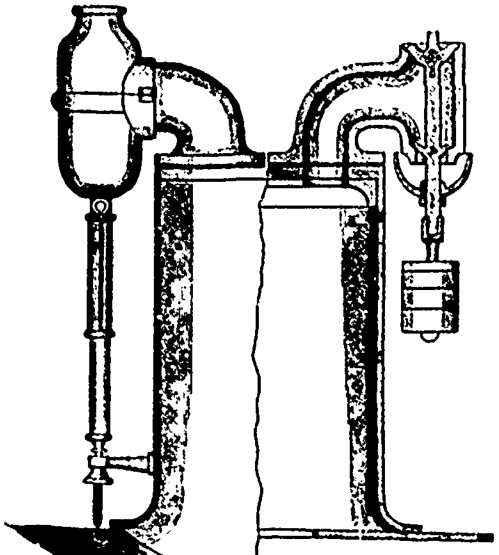


FIG. 51—DOUBLE-SIT SAFETY VALVE.

gradually being cut off, thereby reducing the pressure in the reduction chamber, and upon the upper side of the piston. This reduced resistance to the rising of the piston, and the area exposed to the pressure of the steam in the boiler being somewhat in excess of that of the valve proper, it forces the valve further from its seat, where it will remain until the pressure in the boiler is sufficiently reduced to allow the piston to fall below the apertures above mentioned, when the valve proper will suddenly seat itself.

COMBINATION SAFETY VALVES.

The great objection to combination safety valves is that they are too complicated. The object in this form of valve is to obtain an effective area equal to that due to the diameter of the opening of the valve—a worthy effort. The writer entertains hope that inventors will not despair of success, but will continue their efforts to reach such a result.

In Fig. 53, it will be seen that from the end of the lever, extending downwards, is a bar which connects with the short end of a toggle, or bell-crank lever, to the long end of which the spring balance is attached, and in the

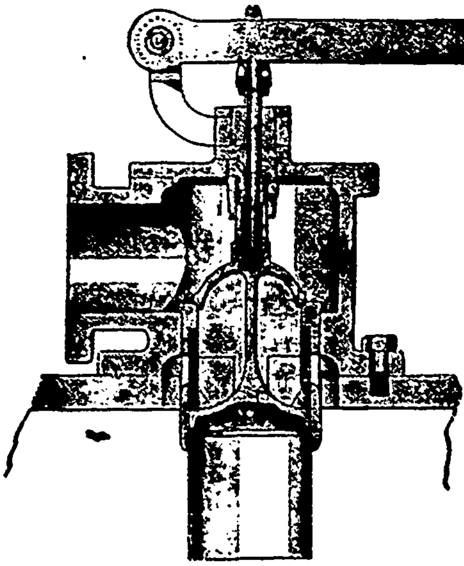
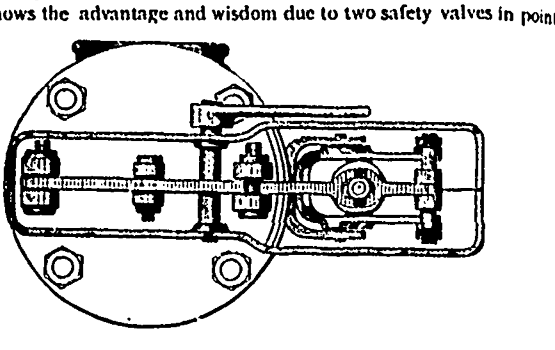


FIG. 52—PISTON SAFETY VALVE.

position to act upon the main lever through the connecting-bar above mentioned whenever the pressure in the boiler overcomes the resistance of the spring-balance, and assists in raising the valve from its sit. The object of this arrangement is to get an increase of lift to the valve.

DUAL SAFETY VALVES.

By the city ordinance for the inspection of boilers in the city of Philadelphia, in accordance with Acts of Assembly approved May 7th, 1864, also ordinance of Councils, appoved July 13th, 1868, all steam boilers are required to have on each boiler, when fired separately, two or more safety valves. When a given safety valve area is distributed over two or more valves, the efficiency for the relief of steam is greater than when the area is contained in one valve, because the circumference of the valve of a safety valve is the measure of the amount of orifice that is presented for the outflow of the steam; for example, an area of 20.62 inches is required, and we find that two valves, each 3⅝ inches in diameter, equal the above, and their circumference amounts to 22.76 inches, but if we have only one valve, its diameter would be 5⅛ inches, and its circumference 16.10 inches. This comparison shows the advantage and wisdom due to two safety valves in point



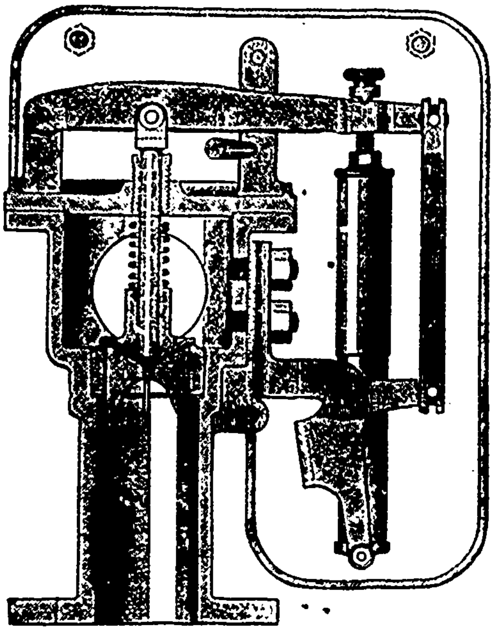


FIG. 53—SPRING AND LEVER LOADED BELL-CRANK COMBINATION SAFETY VALVE.

of safety, regardless of its advantage of less risk of both valves being out of order at the same time.

RAMSBOTTOM'S SAFETY VALVES.

Ramsbottom's arrangement consists of two safety valves held down by a single stout helical spring, placed midway between them. The spring holds down both valves with equal force, and the cross-bar to which the spring is attached, and which rests upon both valves, is prolonged at one end, so as to afford a handle by which the engineer may occasionally try his steam. Any movement of this handle by the engineer, whether up or down, frees one valve by pressing down the other; and it is thus impossible, by holding down or fastening down this handle to prevent the escape of steam, and thus increase the pressure; for to force down, or to force up, the handle would only let off steam. This feature the writer believes is one of the best yet introduced for safety valves. When the pressure rises too high, both valves blow off alike, and both rise to the full extent to which the spring is extended, instead of, as in the ordinary arrangement, to but one-eighth, or perhaps

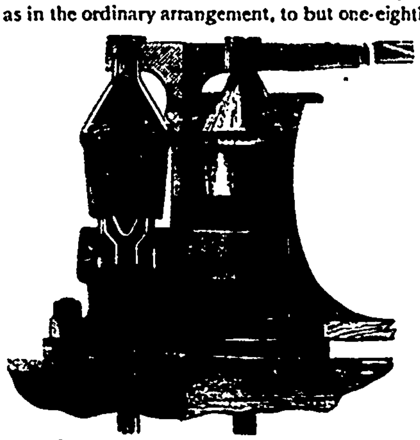


FIG. 54—DUAL SAFETY VALVES.

one-twelfth of the extension of the spring. Even with a strong fire, the steam cannot rise but a very few pounds above the pressure at which the valves are set to blow off.

In this safety valve the pressure can be removed from either valve at pleasure, by merely raising or depressing the free end of the lever, while at the same time the arrangement prevents over loading.

(To be Continued.)

Messrs. Anderson & Godard, 128½ Sparks street, Ottawa, are going into the electrical supply business.

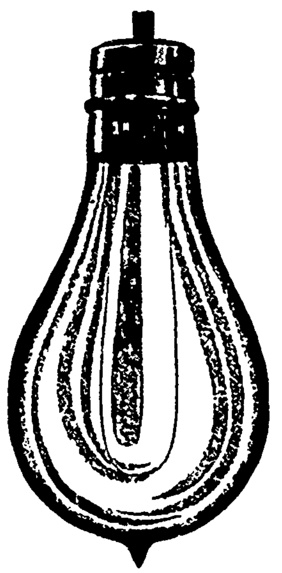
TRADE NOTES.

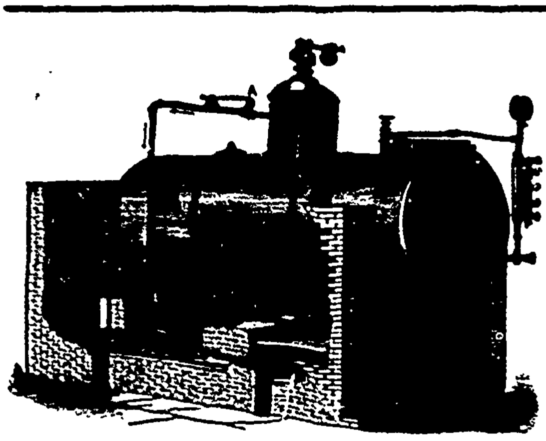
Mr. George Keating of Kemptville, Ont., has recently installed a 350 light alternating electric plant, which was manufactured for him by the Royal Electric Company of Montreal.

La Seminaire de St. Hyacinthe have closed with Miller Bros. & Toms of Montreal for a complete laundry outfit, and the shafting hangers and Hill friction pulleys required for their electric light plant.

Messrs. J. M. Fortier & Co., cigar manufacturers, and Fred. Car tens, of Montreal, have equipped their factories with motors, which were manufactured and supplied to them by the Royal Electric Company of Montreal.

The Royal Electric Company have recently closed a contract with the Zoological Gardens at Montreal for a 50 light arc dynamo and a 400 light incandescent machine, a 40 horse power generator and a complete equipment of 16 trolley cars to run the new system of electrical race-course. This will be the first of its kind in use in the Dominion of Canada and the design was made lately in Paris by some very eminent electricians.





TRADE NOTES.

The Royal Electric Company are installing a motor for the Franciscan Monks at their new monasteries in Montreal.

Messrs. Wm. McKee and James Fyfe of Montreal, have each installed a 2½ H. P. motor manufactured by the Royal Electric Co.

The Royal Electric Co have sold to H. H. Merkley, of Morrisburg, Ont., a 650 alternating machine, with lamps, wires, &c., for a complete central station.

Mr. T. W. Ness, of Montreal, dealer in electrical supplies, has recently removed from 644 Craig street to larger premises at No. 749 on the same street.

Messrs. T. Eaton & Co., Toronto, have added a 50 light arc dynamo with necessary wires, lamps, &c., to their plant. The purchase was made from the Royal Electric Co. Messrs. Eaton & Co. now have one of the largest isolated stations in Canada, with a capacity of 125 arc and 400 incandescent lamps.

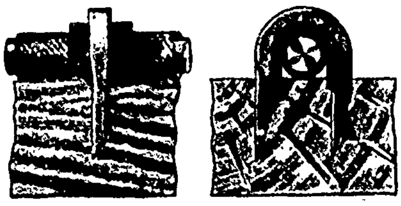
The Royal Electric Company has recently installed electric light plants in Huntsville and Bracebridge. Each of these plants are of a total capacity of 500 lights and the parties for whom they have installed the plants have met with unprecedented success in canvassing for lights and expect to double the size of these plants during the coming year.

The Royal Electric Company last week shipped two car loads of electrical machinery to Messrs. Stuart and Harper of Winnipeg, Man., the plant consisting of a 50 light arc dynamo of their Thomson Houston manufacture, 2000 c. p., 60 arc lamps and a 1500 light alternating dynamo complete with the necessary transformers, wire and other equipments.

The Ball Electric Light Co., Limited, of Toronto, report recent sales to the Wiarton Electric Light Co., one 50 light 4 ampere dynamo (this is an increase order, making total capacity of Wiarton plant, 100 arc lamps or equivalent in series incandescent lamps, of which large numbers are in use.) Also Knechtel Furniture Co., Hanover, 105 light automatic incandescent dynamo and lamps; Toronto Engraving Co., one electric motor, etc. The Ball Co.'s new key socket for series incandescent lamps is having a large scale, as it fits both Heisler and Bernstein lamps and its circuit closing devise is simple and positive without requiring renewals. Porcelain fittings are used in this socket.

A NEW INSULATING SADDLE STAPLE.

The Vulcanized Fibre Co., 14 Dey street, New York, announce that they have secured the exclusive agency throughout the world for the insulating saddle staple, for which as a safe staple, the following among other advantages are claimed: prevents the possibility of injury to insulation, reinforces insulation and discourages



leakage, avoids the difficulties accompanying the use of ordinary metal staples, can be more expeditiously applied than cleats, being also cheaper, neater and stronger. This staple has been approved by the National Board of Fire Underwriters.