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CANADIAN

ELECTRICAL NEWS

AND

STEAM ENGINEERING JOURNAL.

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CENTRAL STATION OF THE PETERBOROUGH LIGHT & POWER COMPANY.

THE Peterborough Electric Light & Power Co., a view of the interior of whose station is herewith presented to our readers, was organized under the name of "The Peterborough Electric Light Co." in the year 1884, the first lights going into operation on May 24th of that year. The original management of the company consisted of: T. G. Hazlitt, President and General Manager; Messrs. Richard Hall, Wm. Walsh, A. P. Poursett, Directors. The Royal Electric Co., which installed the plant, placed one of their electricians in charge for the first year. The second year Mr. V. Brown had charge. Since 1886 Mr. H. O. Fisk, who obtained his electrical education in the Royal Electric Company's works in Montreal, has satisfactorily filled the position.

INTERIOR OF CENTRAL STATION, PETERBOROUGH LIGHT & POWER COMPANY.

In April, 1890, the company was amalgamated with the Gas Company, under the title of the "Peterborough Light & Power Co.," the officers of which are: T. G. Hazlitt, President; T. E. Bradburn, Vice-President; A. Stevenson, Secretary and General Manager, the Directorate being the same as before.

The building occupied by the company as their station was originally erected for the purpose of a pulp mill. It is located on the banks of the Otonabee river, the size being 40 x 70 ft., 2 stories, frame. The station is operated entirely by water power. There are used for this purpose five Leffel water wheels, four 52 in. and one 40 in., working under 11 ft. head. No trouble has been experienced in getting all the power required, nor has there been any perceptible variation of the power. The only difficulty which has been met with has arisen from the wheels becoming sheeted with ice on one or two occasions in the months of April and November. This seems to have resulted in consequence of the temperature of the atmosphere becoming suddenly lower than that of the water. When this occurred, the wheels would gradually become sheeted with ice until the bucket openings were entirely filled up and the wheels became perfect cylinders, when of course their usefulness was temporarily gone. The stoppages from this cause have only amounted, however, to about five hours in all, so that it is not a matter of much moment. Two of the wheels are coupled to one shaft, driving a 650 light alternator; each of the other wheels run two dynamos on an independent shaft. The 40 in. wheel runs a 40 light machine.

The dynamos are placed on the second floor, and consist of one 650 light alternating machine, with exciter, three 40 light, two 25 and one 12 arc light machine. The first mentioned machine is at present carrying 700 16 c. p. lamps. The wires from the dynamos are carried beneath the floor to the switchboard. There are behind the switchboard two folding doors, giving access at any time to the connections at the back of the board, also allowing of the potential of the different circuits being taken at any time by means of a bank of high resistance incandescent lamps in series and a Weston voltmeter, as well as insulation tests in daytime with Wheatstone bridge and galvanometer. These tests are made during all kinds of weather, and a record is kept of the results for future reference. Not only is a record kept of insulation tests, but also of each machine, and of the circuit on which it is working, the voltage between dynamo terminals, number of watts, electrical horse power, speed of the machine, and the load on each machine at time of test, the highest and lowest insulation test for the previous month, also the condition of the weather for the previous six hours, inside and outside temperature at time of test, with such other data as may be considered likely to be of value. These tests are made by means of a Weston ammeter and voltmeter, and one of Queen & Co.'s testing sets, and are all conducted by Mr. Fisk.

The company operate three street circuits, embracing about twenty miles of wire, two commercial circuits, each containing about four miles of wire, and an incandescent circuit covering the central portion of the town, and which is being extended to all parts of the town as fast as the circuits can be constructed.

The company have been using exclusively for more than a year past carbons made by the local manufactory of the town the Brooks Mfg. Co., and with the most satisfactory results.

There are in operation about 100 65 c. p. T. & H. series

lamps, 85 street lamps, 2,000 c. p., 75 of which are all night lamps, and 700 incandescents. Residential lighting has recently been commenced, and the outlook in this direction is said to be very promising.

RECENT CANADIAN PATENTS.

Geo. Cassidy, of Vancouver B.C., has obtained a patent on a belt joint, formed by cutting out of one end of the belt flatways a V shaped gap, the other end inserted and cemented in said gap after shaping it to form an exact counterpart of said gap.

The Reliance Electric Mfg Co., of Waterford, Ont., (Assignees of Frank Bankson Rae, Detroit, Mich.,) have been granted a patent on a current indicator consisting of a magnet, the coils of which are included in the circuit to be measured. A semi circular core-piece tapering from its base to its free end a plate connected to the base and extending toward the free end of the core piece, an armature pivoted to the plate and carrying a ring shaped piece of soft iron embracing the core piece, and a pointer secured to the ring, and a segmental scale for the pointer.

A patent has been granted to Isaac Ives, Albany, N.Y., for the combination on a water wheel of adjustable gates with their gate gear adjusted in an inner fixed case connected with tank, and the buckets, etc., fixed into the circumference of an annular wheel revolving horizontally around case, and fastened to shaft.

THE ELECTRICAL INTERESTS OF OTTAWA.

Ottawa is an interesting city from many points of view. Its situation is pleasant. It possesses in the Chaudière Falls one of the most wonderful water powers in the world, and around these falls are clustered saw-mills almost unequalled anywhere in point of capacity. Being the headquarters of Government for the Dominion, and the place of residence of the Queen's representative, it attracts many visitors. In conjunction with the twin city city of Hull, it can boast of a number of important manufacturing industries.

Second to none of its features of interest are its electrical enterprises, a few particulars of which we take the opportunity of presenting to readers of the ELECTRICAL NEWS. The latest addition to these is the recently constructed

ELECTRICAL STREET RAILWAY,

the perfect operation of which is an object lesson, the effect of which let us hope will not be lost on parliamentary representatives of other towns and cities.

The management of the road is as follows. J. W. McRae, President. G. P. Brophy, Vice President. J. D. Fraser, Secretary Treasurer. The road was constructed in less than two months by Messrs. Ahearn & Soper, of Ottawa, and notwithstanding the rapidity with which the undertaking was carried to completion, the workmanship in every particular is of the most substantial character. The road embraces eight miles of double and four miles of single track.

The equipment consists of sixteen cars of the vestibule type, manufactured by Messrs. Patterson & Corbin, of St. Catharines, Ont. The electric system employed is that of the Westinghouse Electric & Manufacturing Company, single reduction motors of 20 horse power each being used on each car. The dynamo room is located at the famous Chaudiere Falls, where two turbine water wheels drive two 100 horse power Westinghouse compound dynamos and a third machine is kept in reserve. The difficulty in supplying steady current by water wheels was at first a matter of serious difficulty as, owing to the frequent stopping of all or nearly all the cars at the same instant, the water wheels were liable to race. By an ingenious mechanical arrangement the water wheel gates are now raised and lowered instantly, and by the introduction of a novel electric device sufficient load is kept on the dynamos at all times to keep down the speed of the water wheels. This device consists of several coils of iron wire, which are connected in shunt to the trolley circuit, and are so arranged that any current from 12 to 72 amperes may be made to flow through them. The wire is kept cool by being immersed in water, which is changed as it becomes warm. This useful device was designed by Mr. T. Ahearn.

The arrangement and facilities of the Ottawa electric railway for battling with and removing the heavy snow falls are of the most complete character. The snow is swept off the tracks by a Lewis & Fowler electric sweeper, and two Walkaway snow plows drawn by horses follow the sweeper and remove the snow bodily to the curb. A third Walkaway shoves the snow between double tracks on to the unswept track, which is immediately gone over by the electric sweeper, and in turn is followed by the Walkaways. In this manner snowfalls of nine to twelve inches have been handled in half a night throughout the whole length of the line. The snow is then shovelled into large boxes, mounted on double runners, and drawn away. A second sweeper will be in readiness in a few days. Preparations for winter were commenced as early as August. All the ordinary platform cars were converted into vestibule cars to make them comfortable for the motor men. Heavy duck canvas is fixed all around the trucks and almost reaches the rails. This prevents snow from reaching the motors and contributes to the comfort of the passengers. Special track sweepers and brooms are used on each car. The whole outfit is complete, and a more efficient service probably does not exist anywhere in America. The successful and profitable operation of a winter electric service has been so convincingly demonstrated that the influence upon other Canadian cities will no doubt be immediately felt. Much of the success of the road, especially under the severe conditions of the present winter, is due to the efforts of Superintendent J. E. Hutcheson.

The stock of the horse car line which extends from the Chaudiere Falls to Rideau Hall, is now controlled by the owners of the electric road, and it is understood to be the intention to convert this line also to electricity.

The citizens are extremely proud of the electric road, and since it went into operation the traffic has largely increased.

Mr. Ahearn is the inventor of a new form of electric heater, in form an upright cylinder, which occupies about the same space as the ordinary car stove, and will heat a car to a temperature of 70 degrees in the coldest weather. It is understood to be the intention to establish in Ottawa a manufactory for the production of these heaters and other electrical devices.

STANDARD ELECTRIC COMPANY.

THE Standard Electric Company was organized in February, 1891, with the following management: Hon. E. H. Bronson, President; C. Berkeley Powell of the firm of Perley & Pattee, General Manager; James Gibson, Secretary-Treasurer; Edward Seybold, General Agent; J. E. Brown, formerly with the Royal Electric Co., Electrician.

The Company commenced operations in February, 1891, in the old flour mill belonging to the Bronson-Weston Co., pending the erection of a new central station building especially adapted to their purposes. This was done in order to supply light and power to customers who were immediately in need of the same. The plant, which went into operation on the 1st of June, consisted of a 1500 light alternating dynamo and a 60 h. p. generator, built by the Royal Electric Co. of Montreal.

Immediately after the formation of the Company in February, workmen were set about quarrying out the wheel pit at the site of the new building. The work on the building was pushed with great vigor, the stone used being quarried on the spot. The construction is of the most substantial character, the walls being three feet thick, and the joists 12x12 inches, while the whole structure is literally "founded on a rock." The new station building was completed about the middle of August, and opened the latter part of that month.

There were placed in position two 1500 light alternating dynamos, and two 60 h. p. generators. There has since been added to this equipment two more 1500 light machines, and two 60 h. p. generators. The present capacity of the station is 6000 lights and 240 h. p.

The station is so laid out that the generators are all placed in line on one side of the building and the dynamos on the opposite side. These machines are driven from shafts on the first floor. The shafts run parallel with the building and are set on a solid stone foundation, and the foundation and stands of bearings being bolted into the solid rock, make vibration scarcely perceptible. From these shafts the belts cross each other and run to the dynamos on the second floor. Each circuit has its set of potential lines running from the centre of circuit back to potential indicator in the station. On each circuit is placed a reaction coil which keeps potential on each circuit at a uniform pressure. The switch board is a very handsome one, the switches being of white marble and polished brass. The arrangement is such that each circuit can be thrown on to any machine, and any machine on to each circuit.

The company is operating one of the largest motors in Canada, transmitting 70 h. p., and driving Messrs. Martin & Warnocks large flour mill situated a mile distant. The motor runs 24 hours per day for six days of every week, which will be admitted to be

a very severe test of its efficiency. Altogether the company are running about 180 h. p. in motors. The motors consist of 25, 15, 10, and 5 and ½ h. p., the latter being used to drive fans. The line work is of a very superior character.

CHAUDIERE ELECTRIC LIGHT AND POWER COMPANY.

The accompanying illustration represents the just completed switchboard of the Chaudière Electric Light and Power Company's lighting station. The board itself, which was erected by the employees of the company, and the instruments connected without interfering with the efficiency of the service, is built of B. C. spruce having a very pretty grain and not a sign of a knot or "shake." The instruments, ammeters, voltmeters, etc., were all made at the factory of the Westinghouse Electric Mfg. Co., of Pittsburgh, and are models of neatness and reliability. The instrument on the extreme left of the board is the "ground detector" and just below it the "ground detector switch," used every half-hour to see that the circuits are clear of all earth connections or leaks. Along the bottom of the board are the rheostats, by means of which the potential on the various circuits is regulated; next above come the bus rods, the dynamo changing switches, circuit switches, multiple-arcing and small exciter switches, then another set of bus rods. Above the top bus rods are the ammeters and voltmeters with a pilot lamp over each, the letter on the pilot lamp shade indicating the dynamo which supplies current to the instruments beneath it. At the top of the board are the lightning arresters, three different styles being shown, which marks the improvement in this line of the business, the different styles having come along from time to time with new machines. The "station converters" for working the voltmeters and pilot lamps are behind the board, as are also the "compensators," which are used to make up for the fall of potential as the load increases, and save running a potential wire from the centre of distribution. All the wiring is done from behind, the wires from the dynamos coming up through the floor, and those to the circuits going up through the ceiling to a cupola in the roof, where they branch off to their various districts.

SWITCHBOARD, CHAUDIERE ELECTRIC LIGHT AND POWER COMPANY'S STATION.

In May, 1887, the C. E. L. & P. Co., Ltd., began operations with one 250 light incandescent continuous current "United States" dynamo. The station used at that time was a small wooden structure on the Hull side of the Chaudière Falls, put up by R. Hurdman & Co., and now used by them for lighting their large saw mills.

From the first day the lights were turned on the success of the undertaking was an assured fact, orders poured in so rapidly that the officials of the company realized that they would have to go into the business on a much larger scale; accordingly arrangements were at once made with Thos. McKay & Co., proprietors of the Ottawa flour mills, and by the middle of October a three storey building about fifty feet square had been fitted up with water wheels, shafting, etc., and the company moved into its new premises. Towards the end of 1889 there were ten 250 light machines running to their full capacity every day. Up to this time store and office lighting were the only branches of the business which had received any attention, but now people began to demand the same comforts for their homes as they could enjoy at work, and house lighting commenced. For this purpose two 750 Westinghouse alternators were procured. They were rapidly filled up, and worked so well that the management of the company decided to run all their lights by means of alternators. Another building adjoining the station at McKay's was fitted up, an arch cut in the wall, and both are now filled to their utmost capacity with machines, there being eight 750 light and one 1500 Westinghouse alternators in use.

The continuous current U. S. machines which have been replaced by alternators, are used as generators for supplying current to motors, and some of them are doing excellent work in this way. The machines have been removed to a separate building a little lower down the river. The officers of the company are as follows. President, Robt. Hurdman, Vice President Warren Y. Soper, Secretary, Wm. Scott, Managing Director, Thos. Ahearn. The plant almost from the outset has been under the charge of Mr. John Murphy, a native of the city, who has qualified himself for the position under Mr. Ahearn's able tuition.

The company have recently purchased from Pearce & Co., their large saw mill building on the opposite side of the river, to be used as the power house of the street railway, (in which the company are also large stockholders), and for additional lighting machines. There are in place at present in connection with this building three water wheels, giving 1500 h. p., and it is possible to double this capacity. The saw mill machinery is being removed, and the electric plant will be installed as quickly as possible.

SPARKS.

It is said to be the intention of the Edison General Electric Company to put in a big plant at Duluth for lighting purposes, to be run by themselves.

The Royal Electric Co. have recently sold a 2½ h. p. motor to the Dominion Blanket Co., of Montreal, a 7½ h. p. motor to Miller Bros. & Toms, of the same city.

The Royal Electric Co. have installed a complete 500 light alternating plant at Bracebridge, Ont., and a 350 light alternating plant at Huntsville, Ont., a 350 light alternating machine at Kemptville, Ont., and a 50 light 1200 c. p. dynamo for the St. John's Electric Light Co., St. Johns, Newfoundland.

When the tubes of injectors become scaled, do not undertake to clean them with a file or scraper, as a very small enlargement of the area on the jet will interfere with the working of the instrument. Rather remove the tubes and place them in a solution of one part of muriatic acid to 10 to 12 parts of water. *This will soften the scale, and the tube may then be washed.* – *Power*

A newly-designed pulley upon which particular attention has been paid to danger from slipping belts, has been placed on the market. On the face of the pulley at regular intervals are rubber strips with rounded surface and fastened by projections passing through the rim of the pulley. Not only do these strips do away with slipping belts, but lessen the wear on the latter and reduce the friction to the minimum. When worn out they can be replaced at a light outlay. *Manufacturer's Gazette.*

THE ELECTRIC TRANSMISSION OF POWER.*

BY GISBERT KAPP.

LECTURE III.

(Continued from March number.)

As an example of a large modern transmission plant, I select, for illustration, that erected a few months ago for the Schaffhausen Spinning Mills. This example is not only interesting on account of its magnitude, but because it has been planted, so to say, into the very stronghold of rope transmission, namely, at the Falls of the Rhine, where the last generation of Swiss engineers carried out such admirable work in teledynamic transmission that the present generation can only copy, but cannot improve upon it. And the grand example set by Redtenbacher, Amsler, and others, on the Rhine has, as a matter of fact, been largely copied at other places. There is hardly a large engineering works in Switzerland or the South of Germany where rope transmission in some form or other will not be found, but the best days of this system are passed. Till recently, rope transmission held the field absolutely, not because it was perfect, but because there was nothing better. Now, however, we have something better in electric transmission, and the flying ropes are being replaced by the electric conductors. In the first place, the capacity of teledynamic transmission to deal with large powers is limited. During last year, the Niagara Commission inspected a large number of plants in Europe, and came to the conclusion that 330 H. P. is the very utmost which can be dealt with by a single rope, so that above this power we must employ more ropes with a corresponding complication in the gear. I need hardly say that no such limit exists in electric transmission. But there are other difficulties in connection with ropes. They wear out very fast, their support at the translating stations on the line requires the erection of very heavy and costly structures, and they are largely influenced by climatic changes, causing excessive strains at some times, and slipping at others. These considerations have induced the managers of the Schaffhausen Spinning Mills to adopt electric transmission in the very spot where rope transmission, in years gone by, has received its most perfect development possible. The situation of the works is shown on the diagram (Fig. 1). The spinning mills are on one side, and the generating station is on the other side of the river, the distance between the two being about 750 yards. In the generating station there is room for five 350 H. P. turbines, of which four are now in place, but of these only two are as yet used in connection with the electric power transmission I am about to describe. The power of these turbines is sold to the Spinning Company at the rate of £2. 16s. per annual horse power taken off the rope pulleys (Fig. 2). The turbines are horizontal wheels, and their vertical axes are geared by bevel wheels with the rope pulleys, by which motion is conveyed through cotton ropes to the two generating dynamos. The latter are six pole machines, each designed for an output of 330 amperes at 624 volts, and in regular work these machines are coupled parallel. The machines, and, in fact, the whole installation, with the exception of the hydraulic works, has been designed by Mr. Brown, to whom I am indebted for the particulars I now bring before you. The electrical part of the plant was made and erected by the Oerlikon Engineering Works. The line consists of four cables (each having an area of '437 of a square inch), and is supported at four intermediate points, besides the supports at the terminuses. One of the intermediate supports is the old turbine house, which, in former times, was used in connection with the wire rope transmission; the others are towers of iron framework, 46ft. high, one of which is shown to a larger scale in Fig. 1. The span where the line crosses the river is 330 ft., and where it passes along the shore of the river the span is 430 feet.

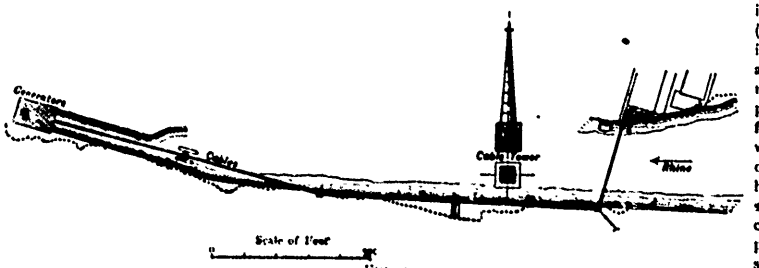


FIG. 1.

You may imagine that the proper support and insulation of cables of that size, and with so long a span, is a matter of considerable difficulty. The use of glass or earthenware insulators on a stalk, as employed for the support of telegraph lines and other light wires, is, of course, out of the question. We must have something very much more substantial, and this has been provided in the manner shown in Fig. 5. Near the top of each post there are bolted to the iron framework four of the boxes shown on this diagram—one for each line of cables. The inner box serves as a kind of junction or connecting piece between the cable ends, which are opened out, as shown. Molten zinc is then run in, and surrounds every single wire, thus making a perfect electrical joint; whilst at the same time, the strain is divided between all the wires in the most even way possible. The inner box is surrounded by an outer box, and the intervening space is cast out with sulphur, which is an excellent insulating material, and, applied in this way, of sufficient mechanical strength to resist the large forces involved in the supporting of these heavy cables.

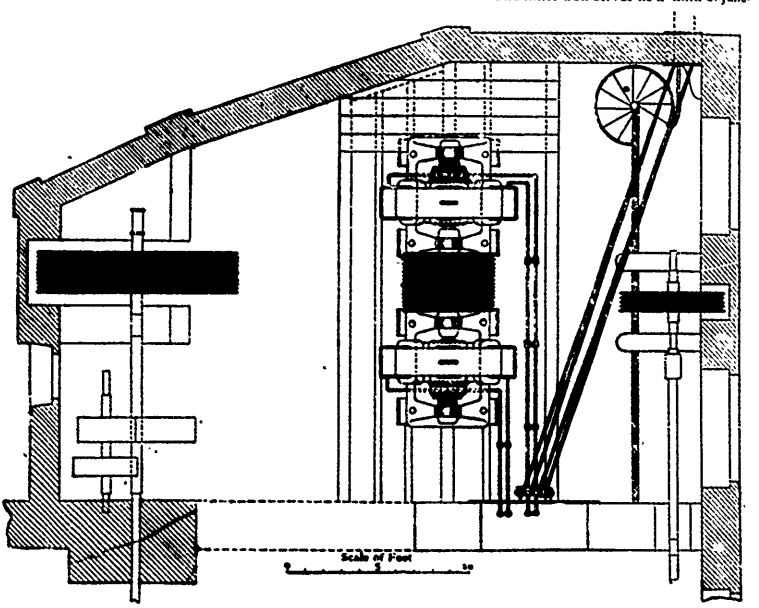


FIG. 3.

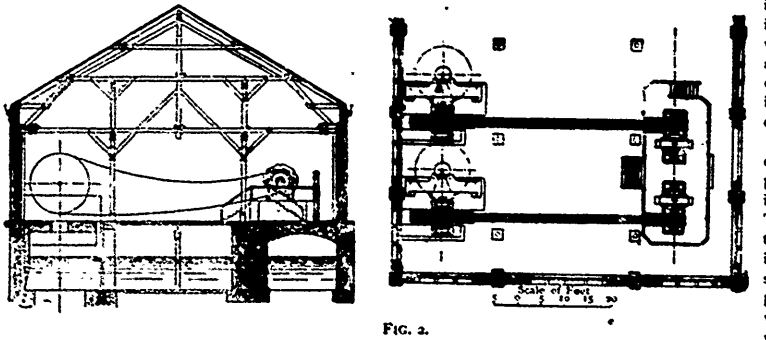


FIG. 2.

In mountainous countries, where thunderstorms are frequent and violent, the protection of lines from lightning strokes is a matter that must not be overlooked. The line I am describing is protected in a two-fold manner. In the first place, there is stretched over the four electric cables a steel wire rope, passing right over the supports, and in good electric connection with their iron framework, and therefore with earth. The object of this arrangement is to act as an ordinary lightning protector, on the supposition that a lightning flash will rather go to earth by way of the steel cable and one of the towers that run along the electric line. But lightning flashes are sometimes very erratic, as was shown experimentally in this very room, in the ad-

able Mann Lectures, which Prof. Lodge delivered before this Society in 1888. It is, therefore, also necessary to make provision for flashes which will, for some reason or other, stray away from the direct path provided for them; and this has been done in the Schaffhausen installation, by the employment of lightning arresters at both terminal stations. At each station there are four lightning arresters, one for each cable. They consist of a pair of toothed plates, of which, however, only one is fixed, the other being movable. When a flash strikes one cable only, it goes to earth by the corresponding plates, and no further damage is done. Should, however, both a positive and a negative be struck at the same time, then the arc set up between the plates by the passage of the lightning flash provides an easy path for the passage of the power current also, in other words, the generator will be short circuited. The object of making one of the plates movable is to cut off the short circuit current before any harm is done to the machinery. The movable plate of the lightning protector is connected to the core of a solenoid, through which the short circuit current must flow. Immediately this current is started, the core is sucked in, and the movable plate falls away from the fixed plate, thus acting the part of an automatic switch.

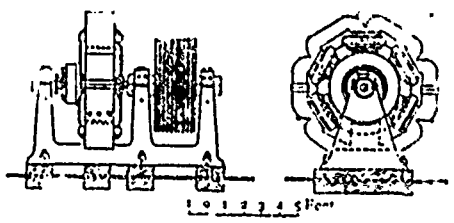


FIG. 4.

Returning now to the Schaffhausen plant, the generating station contains two 300 H. P. dynamos, which are over-compounded, so as to produce a constant pressure of 600 volts at the motor station, the loss in the line being with full current 24 volts. These machines have series-wound drum armatures, running at 200 revolutions per minute. Their more important electrical data, as well as those referring to the motors, are given in the table following.

Fig. 4 shows a drawing of these generators. Fig. 3 is a drawing of the twin motor, which receives the bulk of the power at the spinning mills, whilst the remainder is taken up by a couple of two-pole motors, placed in other parts of the mills. These are not shown on the diagrams, as they are of the ordinary design, with which you are already familiar. The twin motor is rated at 380, and each of the single motors at 60 H. P., making in all 500 net brake H. P. delivered to the mill shafting. The coupling between the motors and the mill shafting is by cotton ropes, as shown in Fig. 3, the arrangement chosen having the advantage that very little side strain is thrown upon the motor bearings, owing to the ropes pulling opposite ways

An interesting and novel feature of the plant is the arrangement adopted for starting gradually, and yet without the use of resistance. In my experiments last week I used current delivered at constant pressure; and, to start the motor gradually, and prevent sparking at the commutator, I was obliged to insert into the armature circuit a variable resistance, which was withdrawn after the motor had gathered enough speed to make this safe. There is no inconvenience in using such a resistance when we are dealing with small currents; but when it is a question of several hundred amperes, and the absorption of as many horse power, the resistance becomes a very cumbersome and unwieldly appliance. To get over this difficulty, Mr. Brown has devised a very ingenious method of coupling between the line and machines, the essential features of which are shown in Fig. 6. As I have already mentioned, there are four main cables, two positive and two

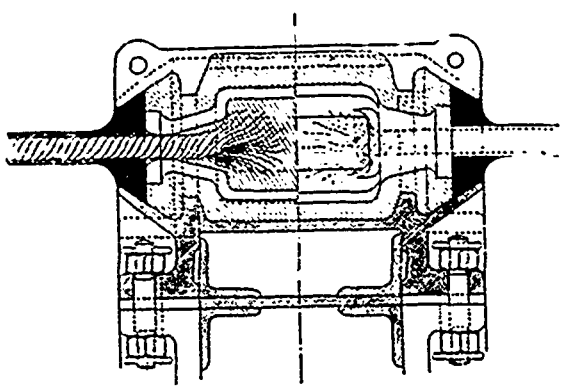


FIG. 5.

negative. Three of these cables contain no switches which need be used for starting, although of course they contain the switches and fuses which may be required for testing purposes and as safety devices, but these, not being essential to the explanation of the starting arrangements, I have not shown in the diagram. Call the two outer cables positive, and the two inner cables negative. The positive cables are looped at both terminuses, and and the inner cables are also looped in this way, but a switch is inserted in the right hand cable at the motor station. Now imagine all the machines at rest, and this switch to be open. To start the plant, the turbine-driven generator, G_1, is set in motion, and the speed run up till this machine excites itself by its own shunt. If you follow the connections you will find that the shunts of the other three machines will at the same time also become excited. The motors have now made their field, and if we start the second generator, G_2, slowly, a power current of gradually increasing strength will be sent through both motors, and the latter will gradually start. As they gather speed, their counter E. M. F., which is indicated by a voltmeter at the motor station, gradually rises, and if it has become equal to the E. M. F. indicated by a second voltmeter in connection with the current from the first generator, G_1, the attendant closes the switch, and the operation of starting is completed. It should be noted that on closing this switch there is no sudden rush of current, since the pressure on both sides of the switch is approximately equal.

Originally the motors were intended to be pure shunt machines, but it was soon found that, owing to the very small armature resistance and armature reaction, it was very difficult to get the load equally divided between them. Mr. Brown, to overcome this difficulty, hit upon the ingenious device of making the machines mutually control each other by putting on demagnetizing main coils, and crossing the connections between armatures and fields, so that the machine, which might at any moment develop a tendency to take more than its fair share of current, would have its field strengthened by the deficiency of current passing through its main turns to the other armature, and would thus immediately raise its counter E. M. F., and check the excess of current, whilst the other machine which was not taking enough current, would have its field weakened, and would thus be forced to take more current. It is clear that by this cross connection even a neglect on the part of the attendant to set the brushes properly cannot materially influence the even division of current and load between the two machines. At the same time the demagnetizing influence of the main coils has the same

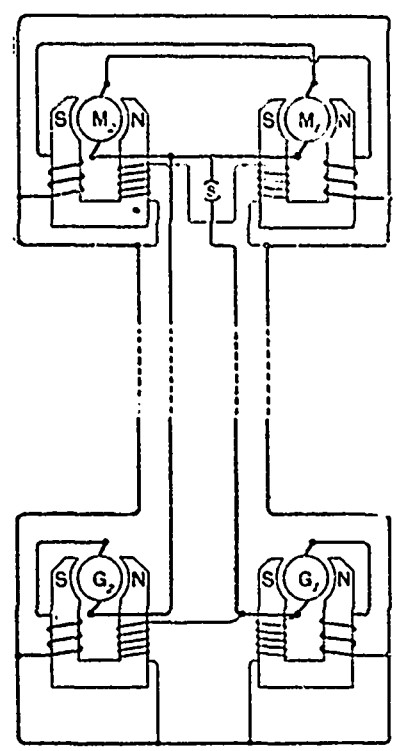


FIG. 6.

effect as if the armature reaction was increased, and insures thus constancy of speed, as I have shown you experimentally last week. In the diagram, Fig. 6, the machines are represented as if they had only two poles each. This I have done to make the diagram as simple as possible, and for the same reason I have shown the shunt and main coils on separate magnet limbs, but you will have no difficulty in translating in your own mind this principle of circuit connections to multipolar machines.

It may interest you to have a few details of a commercial nature regarding this transmission plant. The manufacturers have guaranteed a commercial efficiency at ordinary full load of 78 per cent., also that the machines must be capable of transmitting an excess of 20 per cent. over their normal power for one hour and a half without damage. The wear of one set of brushes to be not less than 2000 hours, and the life of a commutator not less than 20,000 hours. The variation of speed of the motors between running idle and under full load not to exceed three per cent. The total cost of the electrical part of the plant, including cable towers and erection, was £6,800, or £13. 12s. per net horse-power delivered.

Schaffhausen Transmission Plant.

	Generaters.	Twin motor	Small motors
Number of machines	2	1	2
Normal horse-power	300	390	60
Number of poles in magnet field	6	6	2
Revolutions per minute	300	380	350
Terminal voltage	624	600	600
Normal current amperes	330	500	81
Diameter of armature inches	47½	42½	23¼
Length of armature core inches	20	20¼	22½
Radial depth of armature core inches	8	7	4¾
Section of armature conductor sq. inches	103	078	028
Number of armature conductors	316	316	540
Number of commutator segments	153	153	90
Loss in armature resistance per cent	1·46	1·52	2·7
Induction in armature C.-G.-S. measure	7,500	7,000	15,800
Shunt resistance ohms	140	143	295
Loss in shunt excitation per cent	1·35	1·68	
Main turns per magnet	6	4	
Loss in main excitation per cent	3	2	
Type of armature	Drum	Drum.	Cylinder

(To be Continued.)

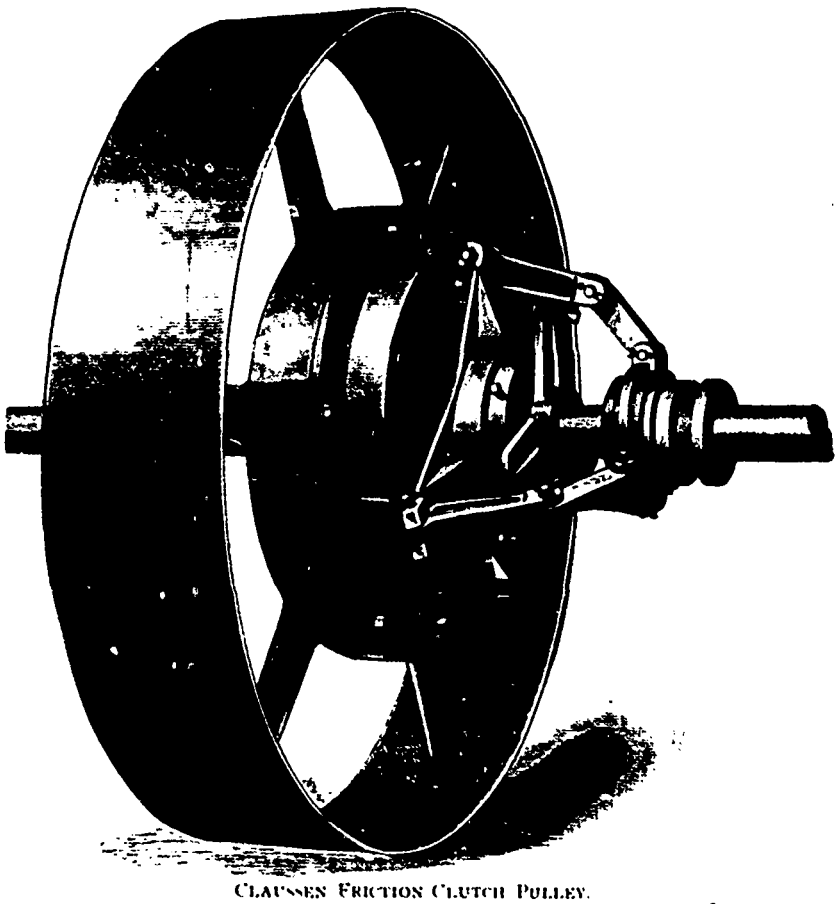
FRICTION CLUTCH PULLEY.

THE accompanying cut represents the Claussen friction clutch pulley, of which Messrs. Darling Bros., of Montreal, are the manufacturers for Canada. It is claimed to be adapted to all kinds of work, and for fast or slow speeds

There is only one place of adjustment on the heaviest clutch, all that is necessary to make adjustment for wear is to turn a collar on the hub till the clutch holds Arrangements are made by which the same pressure is brought on each of the three or four levers operating the pressure rings. This arrangement is permanent and not affected by the adjustment for wear Consequently it is claimed the clutch will under all conditions drive with its whole surface, each square inch of which will do an equal share of the work transmitted.

The surfaces of the clutch are large, consisting of two continuous rings, clamping a third ring by means of levers and toggle joints. When the clutch is thrown out of action the clamping rings draw out of contact with the driven ring simultaneously, thus preventing rubbing and wear and clearing the driven ring 3-16 to ¼ inch on each side when completely thrown out.

On an ordinary sized clutch, the driver consists of 32 pieces, including all screws and pins. On the larger sizes, the number of parts would be 38. This clutch is made of good material and workmanship. The levers and pins are of steel.



CLAUSSEN FRICTION CLUTCH PULLEY.

COMPLIMENTARY DINNER.

Messrs. A. M Wickens, President, and A. E Edkins, Secretary of the Executive Board of the C. A. S. E., while on a visit to Montreal recently, were tendered a complimentary dinner at the Richelieu Hotel by some of the older members of Montreal Branch No. 1. Among the persons present were Mr. Fred. Thomson, of the Royal Electric Co., Capt. Wright, M. E., Mr. Garner, of the Nordberg Governor Co., Mr. Clarke, P. C. E., of the Locomotive Brotherhood, the Presidents of Montreal No. 1 and of St. Laurent No 2 The duties of chairman were happily discharged by P President Hunt, the vice chair being occupied by president T Naden The *menu* was of a most satisfactory character. After the toast to the Queen had been loyally drunk, Messrs. Garner and Nutall responded on behalf of "The Manufacturers," Mr Thomson for "Electricity," Capt Wright for "Education," Messrs Clarke and Acton for "The Locomotive Brotherhood," and Messrs Wickens and Edkins for "The C A S. E." Some excellent songs contributed much to the enjoyment of an unusually enjoyable occasion. A vote of thanks was passed to Messrs. Ryan and Robertson, and the gathering dispersed after singing Auld Lang Syne and the National Anthem.

Mr. Warwick, who was engaged to superintend the operation of the new electric plant for the town of Toronto Junction, has resigned and gone to England to fill a position with the Chelsea Electric Light Co., of London.

Mr. Chas. J. Van Depoele, well-known veteran electrician, died at Lynn, Mass., on March 29th It will be remembered that Mr. Van Depoele's ideas and assistance were employed in first putting into operation the electric railway in connection with the Toronto Industrial Exhibition. In 1888 the Van Depoele company sold out its electric railway system to the Thomson Houston Electric Co., of Boston, whose services Mr. Van Depoele entered as electrician.

QUESTIONS AND ANSWERS.

A correspondent writes :— "Will you kindly give the rule for finding the bursting strain of a cast iron cylinder, also give factor of safety, or rule for commuting the safe working pressure, and please state if rule is used by English Board of Trade or not."

We do not know if the English Board of Trade has any rule for this purpose or not. The strength of a cylinder made of cast iron may be calculated by same formula as is used in calculating the strength of a cylindrical steam boiler, if the thickness of metal in the cylinder be small compared with the diameter.

The bursting pressure is found by multiplying the thickness of the cylinder by the tenacity of the metal, and divided by the radius, or half diameter of the cylinder.

Let p = the pressure in pounds per sq. inch.

Let f = tenacity of the metal in pounds per sq. inch.

Let t = thickness of cylinder in inches, or fractions of an inch.

Let r = half diameter of cylinder in inches.

Thus : $$p = \frac{ft}{r} = \text{bursting pressure.}$$

Cast iron is a metal very variable in quality, so far as tensile strength is concerned; hence, while the formula is strictly accurate, there may be great difficulty in determining the true value of f.

A number of experiments were made at Woolwich dock yard some years ago, and of 850 samples, the tensile strength ranged from 9,417 pounds to 34,279 pounds per sq. inch.

The tensile strength of cast iron is often taken as being 18,000 lbs., which is nearly double what the weakest of the Woolwich specimens showed, and a little more than one-half the strength of the best of the specimens. This uncertainty as to the actual strength of the metal has lead to the custom of using 18,000 pounds or thereabouts as the value of f in the formula, and then using a factor of safety of 10. To calculate the safe pressure use the same formula as for the bursting pressure, but let f = 1800 pounds per sq. inch. If our correspondent means by a cast iron cylinder, the cylinder of a steam engine, something more is required than merely to determine the bursting pressure or the safe working pressure. A safe way to calculate the strength of a cylinder for steam engine is to use the formula given for safe pressure, and determine the thickness of metal and then add about ½ inch for boring or reboring. The formula altered to give the thickness of metal required for a given pressure and diameter would be

$$t = \frac{rp}{f}$$

and with allowance for boring or re-boring

$$t = \frac{rp}{f} + 5 \text{ in.}$$

A cylinder 20 inches diameter to carry a steam pressure of 150 pounds should by this rule be :

$$t = \frac{10 \times 150}{180} + .5 = 5.6 + 3.6 = 1\,1\frac{1}{5} \text{ inch}$$

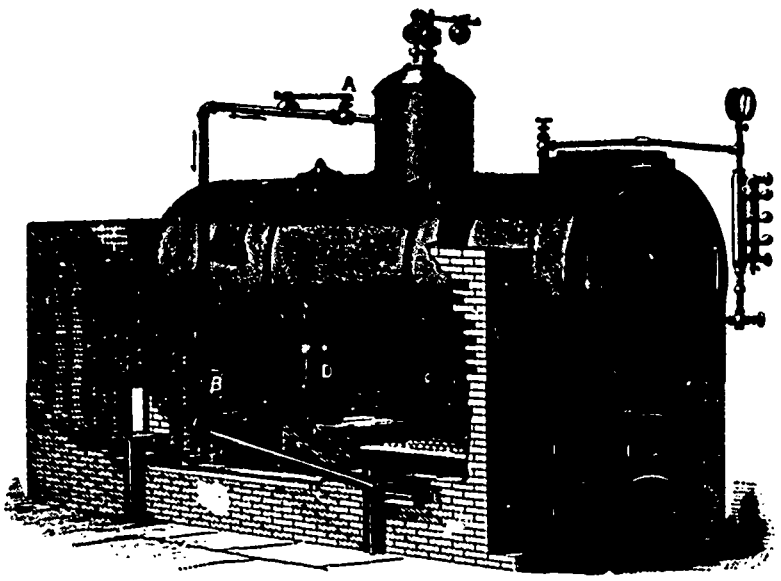
thick, which would be considered good practice, unless the cylinder be so placed that other strains come upon it in the working of the engine.

THE IMPROVED METHOD OF HEATING.

The Cornell Goode device for improving the combustion in furnaces is illustrated by the accompanying engraving. It operates as follows. A small quantity of steam is made to pass through cast iron retorts which are placed in the combustion chamber of the furnace, where they are heated constantly and uniformly to a cherry red. Here, by means of heat, the steam is dissociated into its elementary gases, hydrogen and oxygen. The product from the retorts passes through an air injector, and carries *the air necessary for the combustion of the coal into the* enclosed ash-pit. The oxygen unites with the carbon in the fuel, forming carbonic oxide gas, which with the hydrogen and air rises through the fire and burns around the boiler, forming carbonic acid gas and water vapor. These actions produce a condition in the furnace most favorable to the complete combustion of the coal fuel, and hence the economy.

Perfection of combustion is not the only advantage claimed for this system. With the use of either anthracite or bituminous coal, long flames of burning gases are produced which envelop the boiler, equalizing the work done throughout the entire heating surface, thereby rendering the surface more efficient, and avoiding unequal expansions and contractions of the plates. This prolongs the life of the boiler and boiler setting. The heat is so uniformly distributed throughout the boiler that there *is no* liability of the water being lifted off in sheets. The device is equally well adapted to a boiler which develops less than the rated horse power.

With natural draught a very large percentage of air in excess of that required or utilized by the fuel is supplied, so that large volumes of air are heated and wasted at the expense of the coal. It is claimed that this system supplies only the air requisite for combustion and so distributes this air that is made available, and that this reduces the chimney temperature to but little above that of the steam in the boiler; and further, no clinker is formed whatever the grade or kind of coal used, hence the work of firing is decreased, and the life of the grate bars and furnace walls is prolonged.



The Cornell-Goode Device.

The Cornell-Goode device can be attached to boilers using a small quantity of coal, or those burning 1,000 pounds or more of coal per hour in each boiler.

The Thermolytic Fuel Co., of Napanee, Ont., are the Canadian manufacturers of this device, and will be pleased to supply full information concerning it.

FIRE IN THE G. N. W. TELEGRAPH OFFICES AT MONTREAL.

Some of the liveliest work that has ever been done by the operators of the G. N. W. Telegraph Co. was accomplished in the Montreal offices on the night of March 8th, in connection with the Quebec elections. The returns from a district 800 miles in extent were collected and given out by ten o'clock. At the conclusion of five hours of unusually hard work, many of the operators went home, while others remained to send out special reports to the press. The attention of the night manager, Mr. W. B. Rivet, was called shortly after twelve o'clock to a jet of smoke issuing from between two sub-sections of the Company's big switch-board, into which ran over 100 wires. Seizing a hand grenade, Mr. Rivet attempted to smother the flames, but without avail. An alarm was sent in to the fire department and when the firemen arrived, the fire, running along the oil-soaked covering of the office wire, had reached the ceiling, where covered by the plaster it was extremely difficult to deal with. There was some delay in getting the hose up the winding-stairways to the operating room, but a good pressure was obtained and after an hour's hard fight, during which time the ceiling was torn down, the fire was got under control. The connections from the switch-board to the operating tables were ruined, the floor piled with *debris*, and the two lower flats of the building flooded with water. It was thought at one time that all the valuable apparatus and batteries of the Company would be destroyed, but fortunately these were saved.

The fire was caused by an electric wire falling across the company's *line on St. Gabriel street. The loss is estimated at* $5,000.

The operators stuck to their instruments as long as it was possible for them to do so. One of them who was sending to Toronto advised the operator there that the building was on fire and that when he could get no further response he would know that the wire had given out. Shortly after communication was suspended, and the Toronto man concluded that for once the expected had happened.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Editor Electrical News.

At the last regular meeting of the Toronto Branch, held March 11th., arrangements were completed for the purchase of an indicator and planimeter, for the use and instruction of the members, at a cost of nearly one hundred dollars. A committee of seven was appointed to take charge of the instruments, and to instruct any of the members who wish their services, and loan out the instruments under the following rules:

Rule 1. Application must be made in writing to the chairman of Indicator Committee, who will number the application and give the use of the indicator accordingly.

Rule 2. Any Brother not in good standing in the association will not be allowed the use of the indicator.

Rule 3 The instrument must not be kept longer than 72 hours, under a penalty of 25c. per day for every day so kept.

Rule 4. Any Bro. breaking the indicator must pay 25 of of the cost of repairing, except it be a spring, in which case he is exempt from any charge.

Rule 5. Each Bro. using the indicator must leave a pair of cards from his engine with the drawings to be filed and kept for discussion by the Association.

Rule 6. No Bro. shall obtain the use of the indicator to indicate any engine other than the one he has charge of.

Rule 7. Any Bro. in need of the indicator, on account of a break down, or by reason of taking charge of another's plant, may have precedence of other applications by paying 25c. per day. A book on the indicator and steam engine practice is also to go with the indicator for the benefit and instruction of the members.

I think this is a grand step in the right direction. These instruments are costly, and above the individual reach of many of us, and very few of the employers can be made to understand that it will pay them to buy them for our use. Hundreds, and I may add thousands of dollars have been saved in the coal pile in one year by the use of the indicator, as the valves of an engine cannot be properly set without it. Employers will notice that we are not working only for ourselves, but that we hope in this way to pull down the coal bill. I should like to see many more of the engineers of Toronto join us. The knowledge of the use of the indicator alone is worth far more than the initiation fee of $3.00, not to speak of our lectures and discussions on steam engineering.

Yours truly,

G. C. Mooring,
Chairman Committee.

CANADIAN ELECTRICAL NEWS AND STEAM ENGINEERING JOURNAL

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Advertising rates sent promptly on application Orders for advertising should reach the office of publication not later than the 25th day of the month immediately preceding date of issue Changes in advertisements will be made whenever desired, without cost to the advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change should reach the office as early as the 22nd day of the month.

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

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THE Canadian Association of Marine Engineers is asking for legislation to compel foreign engineers seeking employment in Canada to undergo examination as to their proficiency. The Association has also petitioned the Minister of Marine to make it compulsory upon engineers to exhibit their certificates in their engine rooms.

WE know of an opening in British Columbia for a first-class engineer, with the knowledge necessary to enable him to properly look after two dynamos and other electric apparatus. A year's engagement is required. If any of our readers feel themselves to be competent to fulfil the duties and would like to obtain the position, they may obtain further particulars at the office of this paper.

NOTICE of motion has been given in the Dominion Parliament of the proposed introduction of a Bill to compel the placing of all electric wires underground. Managers of electric companies should at once impress upon their local representatives in the Dominion Parliament the necessity of assisting to defeat a measure which would work ruin to a large number of the electrical industries of the country.

"Engineer wanted, one with knowledge of electricity preferred, to run large stationary engine, must be well recommended"

THE above advertisement clipped from a Toronto daily paper, may be regarded by engineers as one of the straws showing in which direction the wind is blowing. As time passes, engineers possessing a knowledge of electricity will not only be "preferred," but for the most important positions such knowledge will be regarded as an indispensible qualification. Those engineers who may not thus far have applied themselves to an understanding of electrical principles, should lose no time in doing so.

IN these days when electricity is being pictured as a destroyer of life, it is refreshing to come across a person who has faith in its life giving or life preserving qualities. The writer had a conversation with such a man a few days ago. He was wearing on his wrist and ankle a couple of turns of copper wire as a preventative against rheumatism. Without professing to know its mode of action, he cites the case of a friend who was so crippled by rheumatism as to be powerless to move his limbs, but who, by wearing copper wire in the manner described, was entirely freed from the disease. Perhaps some of our electrical experts will be able to explain this phenomena.

NOT long ago the steam pressure failed in a boiler which had been working well for some years. The boiler was stopped and opened up for examination. A great mass of greasy deposit was found inside, and it was estimated that a scum of about two inches thick of grease had been floating on the top of the water and had interfered with the steaming of the boiler. Had much of the stuff got fast on the plates exposed to the heat of the fire, there would soon have been only fragments of a boiler left. The engineer is to be congratulated on having had sense enough to open the boiler to look for the missing steam. Oil is a very good thing in its right place, but inside of a steam boiler is not the right place.

WE print a communication referring to the fact that the Toronto Branch of the C. A. S. E. have expended nearly one hundred dollars in the purchase of an indicator and planimeter for the use and instruction of the members. Such a tangible effort to improve the status of its members reflects the greatest credit on the Association, and presents in the clearest possible light, the praiseworthy objects which it is seeking to promote. We heartily second the hope expressed in our correspondent's letter that many engineers at present outside of the association will see the desirability of connecting themselves with it. Employers should also give it their encouragement and support, inasmuch as the organization is one which will result to their advantage.

HOW long should a steam engine last? That is a question more easily asked than answered. As the durability of the engine depends first on its construction, and then on the care taken of it Engineers ought to take a pride in keeping their engines bright and clean. Owners should not grudge whatever is needed in order that this may be done, as it prolongs the life and good work of the engine. An engineer who can feel com-

fortable and at home in a dirty engine room, looking at a greasy rattler throwing the oil around, we hope will soon be an extinct variety of the engineer genus at least in this country. Some engines get used up in a few months, but we lately saw one working very smoothly which was made in Glasgow in 1840 and has been in use ever since. It was a credit both to the builders and to the men who have had charge of it.

THE Hamilton street railway franchise has been secured by the old company, and steps will at once be taken to substitute electricity for horses. The people of Hamilton have sensibly become convinced that the trolley system is the only one which is at present practicable. In Toronto the opposite course is being pursued by a section of the City Council. The opinions of aldermen whose knowledge of the subject is of the most meagre description seem to carry greater weight than the recommendations of the City Engineer, the opinions of electrical experts and the results of all the experimenting that has been done by American cities. The outlook at present points to the decision regarding the system to be adopted being delayed to an extent which will give the Street Railway Company good grounds for damages against the corporation.

A BRITISH Columbia correspondent, who is interested in a large deposit of first-class mica, enquires of the ELECTRICAL NEWS what the prevailing prices are in Ontario. He states that he would prefer to sell here rather than in the States. We have pointed out to our correspondent the fact, which may have interest for other readers as well, that large deposits of mica exist in Ontario, and that during the last year or two many hundreds of tons have been mined, much having been sold to the Thomson-Houston Co., of Boston. The Canadian demand is as yet small, although steadily increasing, owing to the fact that the material is constantly being applied to new uses in connection with the electrical business. Taking into consideration, however, the limited demand and the abundance of the material to be had in this province, it seems altogether improbable that mica could be shipped here from British Columbia and sold to advantage.

THE operation of an electric railway and three electric light companies makes the successful working of the telephone a matter of extreme difficulty in Ottawa. The induction on the Bell Company's long distance grounded lines made them practically useless either day or night and the business fell off to a mere fraction of its former volume. To remedy the trouble the company's assistant manager, Mr. E. C. Dewar, has adopted the following device. Between the central office and the outskirts of the town a metallic circuit was strung and connected to one coil of a transformer placed under shelter on a pole; to the other coil was connected the long distance line and a line to the earth. The result is most satisfactory—all noise from power and light currents having disappeared. Some difficulty was at first experienced in ringing through the coil, but by speeding up a power generator and ringing on both sides of the metallic circuit, signals can be sent to any office on the line. The resistance of each coil in the transformer is, of course, the same, about 67 ohms.

AT the last meeting of the Executive Committee of the Canadian Electrical Association, there were handed in twenty-two applications for membership. This must be considered very satisfactory progress. The more the possibilities of the Association are considered, the more apparent it becomes, that if properly supported and conducted, it will prove a decided benefit to the various departments of electrical business. The Executive Committee are discharging their duties with commendable energy and faithfulness, a proof of which is to be seen in their readiness to come long distances to attend the business meetings in Toronto. Arrangements for the first annual convention in June are rapidly assuming definite and satisfactory shape, and there is good reason to anticipate that the event will prove one of much interest and profit. Every person interested in electrical matters in Canada, would find it an advantage to become a member of the Association and assist in making it of the greatest benefit in the diffusion of electrical knowledge, and in guarding and promoting electrical interests.

ON the 12th March a large fly wheel in the electric light station at Cincinnati is reported to have burst when making 73 revolutions per minute, and to have caused damage to the extent of $20,000. From the accounts published the wheel was 24 feet in diameter, and at 73 revolutions the rim would move with a velocity a little over one mile per minute. The frequent bursting of fly wheels of cast iron should lead engine builders to be more careful in the construction. The tensile strength of cast iron is a very uncertain quality, and as wheels are often made, the internal strains, produced while the metal is cooling, frequently strain the arms almost to the point of rupture. The rim and the arms should be cast separately, and the wheel carefully built and well fitted and exactly balanced. In these days of steel, the arms might be of steel, or else have no arms at all, but use discs of steel boiler plate to connect the central hub with the outer rim. The outer rim and the central hub might be of good cast iron, and the discs could be rivetted to them.

THE daily press of the United States and Canada has been largely instrumental in imbuing the public mind with an exaggerated idea of the dangers attending the use of overhead electric wires. We were consequently pleased to see it announced that the annual convention of the Canadian Press Association would be held this year in Ottawa, being satisfied that an opportunity of seeing an electric railway in actual operation by the trolley system would give the members a more practical acquaintance with the subject and serve to correct some of their erroneous ideas. We had the satisfaction of hearing one member of the Association remark on the day following his arrival, that he was suffering from a great disappointment. He had always understood that where electric railways were operated by overhead wires it was quite a common occurence to see persons fall dead on the street. After having spent a day in the city he had not witnessed a single death as the result of the "deadly" overhead wire. Judging by what is appearing in the daily papers of Toronto at present, it would seem that Toronto journalists did not attend the convention, and also that they have not as yet had any other opportunity to meet with the same disappointment as that of the member referred to.

THERE is considerable agitation in some of the largest cities in Ontario at the present time over the probable adoption of the trolley system for the operation of their street railways. Advocates of the storage battery system are using every effort in their power to keep up the cry of "away with the trolley," but there can be no two opinions among those who know the results of the tests and trials of the different methods of street propulsion, as to which is the superior system. While cars have been operated, and are being operated at the present day by storage batteries, yet it is at a great loss in profits in comparison with those that are being operated by the trolley system. True it is, that so far as the appearance of the streets is concerned the storage battery has the advantage, but when it is considered that a storage battery car is apt at any minute to become stalled--when perhaps miles from the station—through a sudden and unexpected giving out of some of the plates, necessitating the sending of a team of horses to haul it into the car house, it will be plain to everybody that the trolley has the advantage, for as long as the current is supplied the trolley will take off its quota and fulfil its requirements at all times. An armature may burn out, but so it will with either system, provided the construction is poor. The only argument then against the trolley is its unsightliness, but in this age of push, sightliness is of secondary consequence to utility, the primary object is to get where one wants to go at a more rapid rate than by means of horse power. While we are emphatic in our statement that at this time there is nothing in existence to equal the trolley, yet we are just as emphatic in saying that there is a time coming when the storage battery will be so improved that it will be an unqualified success, and when that time shall have arrived the trolley will have to go. It therefore behooves corporations and others who have railway deals on hand at present, to make their agreements with the railway companies in such a way that they will be compelled to change to the more improved method just as soon as it is a success in every way. In the meantime the should adopt the trolley, and retire the overworked quadrupeds who are doing duty

as street car motors, much to the disgust of a large majority of people who are compelled to use the street cars to cover the distance between their homes and places of business.

THERE is perhaps no better method by which electric lighting companies may increase their revenue than to supply power by means of electricity distributed in small parcels over a considerable area of territory, and we feel it our duty to point out to the managers and directors of such companies the benefit that will be derived from branching out in this direction, being sure that the receipt in power rentals will in all cases fully compensate them for their first outlay in plant. This applies principally to cities of from ten to fifteen thousand inhabitants and upwards. Not only is the steam producing plant worked more economically, but it reduces the cost of maintaining the electric light plant also, on account of the same help, such as linemen, dynamo cleaners and attendants being able to take their part in the construction and maintenance of the power lines and plant generally. There are to-day few cities in Canada of the size spoken of, in which at least 100 horse power could not be installed in small motors ranging in size from ¼ h. p. to about 10 h. p. It may not be generally known, but it is a fact nevertheless, that with a 50 h. p. generator installed, at least 100 h. p. can be sold on the circuits. From data obtained in cities on the other side of the line where motors are being operated by electric lighting plants, it is learned that the use of such motors averages about one third of their rated capacity, so that really three times the capacity of the generator could be sold on the lines were it necessary to do so, but a safe and practical margin to work on is an overload of 100 per cent., or just double that of the generator, as this 100 h. p. should turn in a revenue, running 10 hours a day, of not less than $60 per horse power in small motors, it will be readily seen that a revenue of $6000 a year from such source will not only pay a big interest on the investment, but will add materially to the shareholders' profits. A first-class plant, such as here mentioned, should be installed for a sum not greater than $10,000, probably less. Of course, in supplying such power, it is best to make a graded price per year according to the size of the motor installed, a fair rate for which, practice teaches us, is about as follows: ¼ h. p. per year $30.00; ½ h. p. per year, $50.00; ¼ h. p. per year, $70.00; 1 h. p. per year $90.00; 1½ h. p. per year $130.00; 2 h. p. per year $140.00; 3 h. p. per year $195.00; 4 h.p. per year, $250.00; 5 h.p. per year, $300.00; 6 h.p. per year $350.00; 7½ h.p. per year, $400.00; 10 h.p. per year $500.00, and so on, beyond which size a stated amount per h. p. can be charged. There are very few cases in which, if these prices prevail, the motive power necessary to run an ordinary shop cannot be supplied for at least 25 per cent. less than the parties can run their own power by means of steam engines. Another suggestion in this connection here crops up, which is, that a shop or factory of any kind, supposed to be using from 15 to 20 h. p. with their steam engine, can be operated successfully in every case with not more than a 10 h. p. electric motor, for such is the elasticity of a good motor that it will carry a temporary overload of from 25 to 50 per cent. according to the conditions. There are few factories to-day using a 15 to 20 h. p. steam engine, whose actual requirements average more than three-quarters or one-half of that amount, and it is only an occasional and very rare occurrence when their actual need ever goes beyond 10 horse power, and then only for a very short period, at which time the motor will be found able to "get there." All things considered, we feel that we are offering the best possible advice when we say, by all means install a power plant, and work it in conjunction with your electric light plant at once. Do not hang back; it is bound to pay a big return for your investment in every case, besides giving a status to your company that it cannot otherwise possess.

THE use of friction clutch pulleys in modern electric light and power stations is undoubtedly a move in the right direction, for by their use it is possible for the dynamo attendant to handle his apparatus in the manner most convenient for the good operating of the plant; but it behooves the parties who are contemplating the use of such pulleys to not only look well into their requirements in that direction before purchasing, but also to see that they get the most suitable for their purpose. As usual in such cases, there are "clutches and clutches," some of them entirely inadequate for the purposes they are frequently sold for. This article is not meant to condemn any particular make of clutch pulley, but simply to point out to contemplating purchasers what is necessary and what is not necessary in a clutch pulley for use in a dynamo station. It must run steady without any wobble, it must be perfectly balanced; it must be as light as possible, consistent with good and strong construction, it must be able to stand on a running shaft for 20 or 25 hours or more without dangerous heating in its bearings; it must be capable of being thrown off or on without the exertion of a large amount of muscular power, it must be capable also of being thrown in, and kept running for a week or more without being thrown out again, but when thrown out must run idle on the shafting as before, it must be so made that it will carry an overload of at least 100 per cent., so that in case of a temporary short circuiting of a dynamo it will be able to bear the strain of the temporary overload, and last of all, it must be such a clutch that if there is any slipping of a grip or grips and it is necessary to stop the pulley so that they can be set again, it can be done without having to stop the engine and perhaps several other pulleys on the same line of shafting operating dynamos to adjust this one—in other words, it should be such a clutch pulley that when it is necessary to stop the pulley the clutch comes to rest at the same time. This will be found on consideration to be a most important point in the selection of a clutch pulley for the running of a dynamo, particularly if, as has been pointed out before, there are more than one running from one line of shafting and one engine. Another important feature that should be well looked into, is the ability of the pulley to lubricate its bearing in a thorough manner when at rest, avoiding thereby the destructive heating effect caused by poor lubrication and the consequent melting of the babbited sleeve bushing. As to the matter of cost, we may say that when it is taken into consideration that to stop any one or more dynamos on a line shafting without shutting down the engine it is necessary to have either a loose pulley or belt holder of some kind, whereas with the clutch there is none required, it will be plainly evident that when an ordinary cast iron pulley is bought at a certain price, and the additional cost of a loose pulley or idler is added to it, there is very little difference in the price, and that difference is more than compensated for by the fact that there is no wear or tear on the belts, as there undoubtedly is with any shifting device, no matter how well made it may be. We feel positive in making the assertion that the life of a belt thrown on to idlers every day is shortened by fully 25 per cent. There is no intention of recommending anybody's make of friction clutch pulleys, nor is there any intention of treading on any of the numerous makers' toes, but this much we can say, that we know that there are some clutch pulleys made (and in Canada, too,) which fill the bill to perfection; and if this article shall be the means of inducing but one manufacturer of clutch pulleys, whose pulleys do not come up to the requirements, to make them conform to it in every particular, or if it shall be the means of proving beyond a doubt to at least one central station manager that the clutch pulley is a necessary piece of machinery in his station, we shall feel that its mission has been more than filled to our satisfaction.

ELECTRICAL CONSOLIDATION.

A CONSOLIDATION of the electrical interests in the city of St. John, New Brunswick, has been effected by the organization of a new company known as the Consolidated Electric Company, Limited, which has taken over the Eastern Electric Company, Limited, the New Brunswick Electric Company, Limited, and the St. John City Railway Company, and thus becomes one of the largest companies in Canada. The officers are: John F. Zebley, of New York, president; H. B. Zebley, of New York, secretary-treasurer; Chas. D. Jones, of St. John, manager, backed by a strong board of directors composed of New York and St. John gentlemen.

The Peterboro Electric Light and Power Co., have purchased from the Royal Electric Co., a 40 light arc dynamo.

Mr Robt McGowan the owner of the Ball electric light plant at Durham, Ont., has purchased from the Ball Co., the 50 arc plant at Oakville, Ont., where a contract has been made for 20 arc lights at 15 cents per night. The lights are said to be giving satisfaction, and it is expected that their number can be doubled.

CANADIAN ELECTRICAL ASSOCIATION.

A MEETING of the Executive Committee of the above Association was held in Toronto on March the 16th. The following members were present:- Messrs. J. J. Wright, in the chair, K. J. Dunstan, John Carroll, S. J. Parker, H. O. Fisk, D. Thomson, I. H. Wadland, John Yule, W. A. Johnston and the Secretary.

Messrs. Thomson and Wadland reported that the Hamilton Electric Light Co.'s old premises could be had for exhibition purposes in connection with the annual meeting.

The Secretary was directed to write to Canadian electrical manufacturers requesting to know whether they would be willing to send exhibits to Hamilton.

It was resolved that circulars be printed in accordance with the draft prepared by the sub-committee appointed at last meeting, setting forth the objects of the Association, and sent to all persons supposed to be interested.

The following persons were elected to active membership in the Association.- Hugh Neilson, Jas. A. Baylis, Bell Telephone Co., Frederic Nicholls, manager Toronto Incandescent Electric Light Co., Toronto; W. J. Morrison, Cobourg Electric Light Co., Toronto; A. Stevenson, manager Peterboro Light and Power Co.; J. H. Greer, Peterboro' Light and Power Co., Peterboro', Ont.; W. B. Shaw, electrician, Montreal, F. B. Allen, Reliance Mfg. Co., Waterford, Ont., George Wilkes, Brantford Electric Light Co., Brantford, Ont., L. B. McFarlane, Bell Telephone Co., Montreal.

The following persons were elected as Associate members. Robt. F. Dickinson, Electric Light and Power Co., Hamilton, J. A. Doucett and W. A. Tower, Bell Telephone Co., Toronto; Alex. Taylor, Edmonton, N. W. T.; J. E. Saucier, manager Electric Light Co., Kamloops, B. C., Wm. Bourne, Edward Bourne, Toronto Electric Light Co., Toronto.

A number of applications for membership were handed in at the close of the meeting, which will be considered at next meeting of the Committee.

PORT ARTHUR ELECTRIC RAILWAY.

The new electric railway at Port Arthur, Ont., was put in operation about ten days ago, unde the direction of Messrs. Barr and Peterson of the Edison General Electric Co., who were the contractors. The road connects the town of Port Arthur with the town of Fort William, and traverses a distance of three and three-quarter miles.

The trial trip is pronounced to have been a most successful one. A distance of three miles was covered in 12 minutes, and the movement of the cars is said to have been so steady and easy as to delight the onlookers. The cars, which were manufactured by Messrs. Patterson & Corbin, of St. Catharines, Ont., are 18 feet in length, inside measurement, and finished in hard wood. Under the seats are placed Burton heaters. There are seven plate glass windows at either side of the car, while in the dome there is a group of three electric lamps. The front and rear ends are supplied with electric lamps, backed by powerful reflectors. The cars can be stopped within a space of ten feet. Each truck is equipped with two 20 horse power motors. The metal finishings, hand rails and ornaments are highly burnished brass, the outsides of the coaches is painted in royal red, sea green and other colors, with gold monograms, the whole combining beauty with strength and utility. The power house is 50 x 50 feet, with engine room in addition. It is situated at the mouth of the Current river and fifteen feet from the water's edge, so that steamships can discharge coal into the boiler room. The engine, dynamos, shafting and immense fly wheel, weighing eleven tons, are supported by massive stone and cement piers. The engine is a Wheelock, with a capacity of 150 h. p., manufactured by Messrs Goldie & McCulloch, of Galt. It is the intention to utilize the great water power which hitherto has served no useful purpose, and to transmit power to the manufacturing industries of the towns. A temporary structure in the centre of Port Arthur is at present being utilized as a car house. There is *telephone communication between the office and power house*, the car house and the station at the Fort William terminus. Connected with the car house there is a well equipped repair shop.

The Standard Electric Co., of Ottawa, have just added to their plant a 25 h. p. motor manufactured by the Royal Electric Co., of Montreal.

LUBRICATING OILS.

THE question of lubricating oils is an important one to all managers of electric generating stations, and there exists considerable difference of opinion as to which oil gives the best satisfaction in practical use. Naturally most makers of oils claim that their own is superior to any others, and there is unquestionably some grounds for these claims, as many of the oils are of *superior merit*.

During the Convention of the National Electric Light Association in Buffalo last month, Mr. F. A. Lane, of Cleveland, Ohio, made a few remarks at one of the meetings on the subject of lubricating oils, which were of interest. He said that most people were under the impression that it was necessary to use lubricating oils of high viscosity and low gravity in order to get good lubrication on heavy or high speed machinery. He said that after extended experiments it had been found that a light oil, light in gravity and low in viscosity, was the oil that would give the best satisfaction in the lubrication of both high speed and heavy machinery. In the case of machinery running at very high speed an increase of oil will increase the temperature, and unless oil enough to absorb the heat is used, so that the oil will run away, taking the heat with it, the heat cannot be reduced by a large amount of oil. Mr. Lane recommended an oil of about 32 gravity and 140 viscosity. He instanced the Calumet and Hecla mines, where lard oil was used up to two years ago, but now a mineral oil is used. Objection was sometimes raised to oils because they produced a gummy substance, but this is usually a scale making material, which comes from the walls of the cylinder. As a rule, any oil that will produce a gummy substance is a good oil.

STANDARD MATERIALS ADOPTED BY THE AMERICAN BOILER MAKERS' ASSOCIATION.

CAST IRON.--*Should be of soft, gray texture and high degree* of ductility. To be used only for hand-hole plates, crabs, yokes, etc., and manheads. It is a dangerous metal to be used in mud drums, legs, necks, headers, manhole rings, or any part of a boiler subject to tensile strains: its use should be prohibited from such parts.

STEEL.--Homogeneous steel made by the open hearth or crucible process, and having following qualities, is recommended for use in all boilers, and shall receive the endorsement of this association by means of the protected stamp of the association:

Tensile Strength.--55,000 to 65,000 lbs. per square inch.

Elongation.--20 per cent. for plates ⅜-inch thick, or less; 22 per cent. for plates from ⅜ to ¾-inch thick; 25 per cent. for *plates over ¾-inch thick.*

Test Section to be 8 inches long, planed or milled edges; its cross sectional area should be not less than one-half of one square inch, nor shall its width ever be less than the thickness of the plate.

Chemical Tests.--Not more than 0.04 per cent. phosphorous. Not more than 0.03 per cent sulphur. Percentage of carbon and maganese left to the judgment of the steelmaker.

Bending Test. Steel up to ½ inch thickness must stand bending double, and being hammered down on itself; above that thickness it must bend round a mandrel of diameter one and one-half times the thickness of plate, down to 180 degrees. All without showing signs of distress.

Bending Test Piece to be in length not less than sixteen times thickness of plate, and rough, shear edges, milled or filed off. Such pieces to be cut both lengthwise and crosswise of the plate.

All tests to be made at the steel mill. Three pulling tests and three bending tests to be made from each. If one fails the manufacturer may furnish and test a fourth piece, but if two fail the entire heat to be rejected.

Certified Copies of tests to be furnished each member of A. B. M. A. from heats from which his plates are made.

Flanging to be done at not less than a good red heat. Not a single blow to be given after the plate is cooled down to less than cherry red by daylight. After flanging, all plates should be annealed by uniform cooling from an even dull red heat for the whole sheet in the open air.

Rivets to be made of good charcoal iron, or of a very soft, mild steel running between 50,000 and 60,000 pounds tensile strength and showing an elongation of not less than 30 per cent. in eight inches, and having the same chemical composition as specified for plates.

SAFETY VALVES--THEIR HISTORY, ANTECEDENTS, INVENTION AND CALCULATION.

By William Barnet le Van

(Continued from March Number.)

In 1857, James Webster was granted a patent in Great Britain (No. 1,955), for an improvement or improvements in safety valves. Several forms are

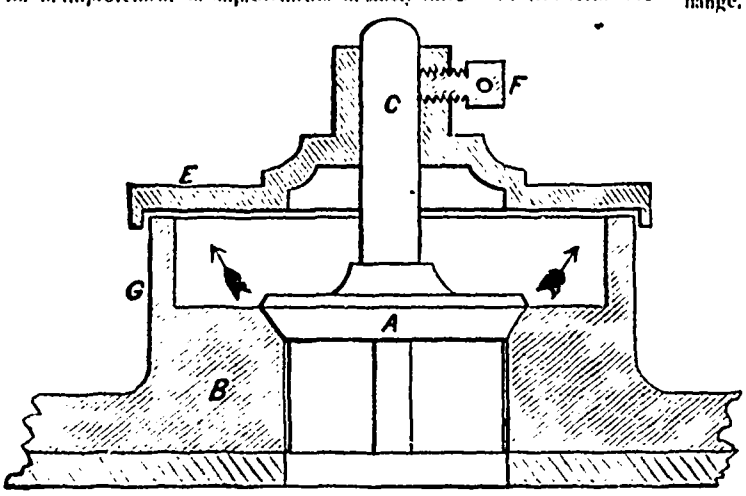


Fig. 27.—James Webster, July 14, 1857.

described in the specifications and shown in the drawings, some of them substantially identical with Ritchie's, and others equivalent thereto. In Webster's valve, the lip, or "compensating flange," instead of being formed in one piece of metal with the valve, is generally a separate and larger disk, attached to the valve stem above the valve, and the annular chamber, instead of being, as in Ritchie's, a mere concave depression around the valve sit, is a considerable chamber around and above the valve, and between the valve and the disk. The "stricture" is formed by a cylindrical ring rising from the metal of the valve sit, at a little distance from the edge of the valve, and either embracing the rim of the disk, as shown in Fig. 26 -exactly as in Ritchie's device—or itself encircled by a downward-turned rim on the disk, resembling the cover of a snuff-box, a clearly equivalent device as shown in Fig. 27.

In another form, the superior disk, instead of being securely fastened to the valve stem, so as to act with the valve as if both valve and disk were one piece of metal, is connected therewith by means of a coiled spring, which admits of relative motion between the valve and the disk, as shown in Figs. 29 and 30. This is a new element, which has no resemblence to anything in Ritchie's patent.

In another form, the cylindrical envelope, or constricting ring, is closed at the top; the disk becomes a closely-fitting but freely-moving piston, and egress is given to the escaping steam by means of holes drilled through the walls of the encasing cylindrical ring, as shown in Fig 30. There are corresponding holes in the rim of the piston, or disk, which come opposite the holes in the encasing cylinder when the valve is lifted to a desired height

In still another form, an ordinary safety valve, with conical sit, surmounted by a short cylindrical piston rising from its outer edge, which fits closely but freely into cylindrical envelope rising from the metal of the valve sit, as shown in Fig. 31. In the form Fig. 31 there is "no

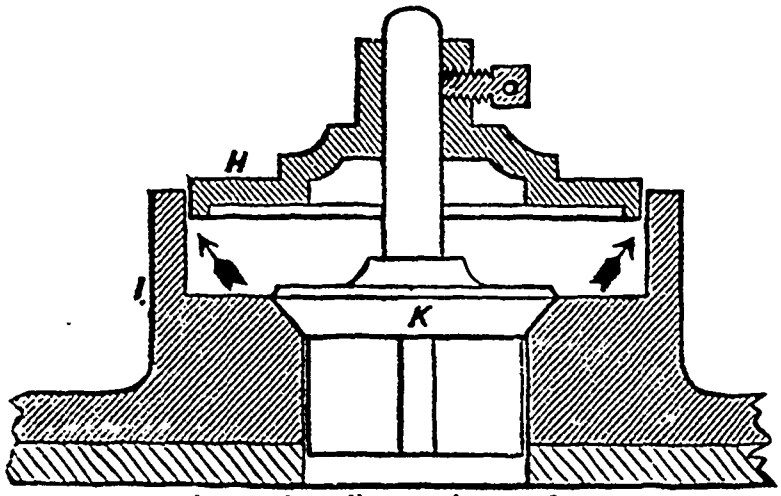


Fig. 28 -James Webster, July 14, 1857.

annular chamber" properly speaking nothing to represent it except the space between the valve and its sit so that there is, properly, no "stricture, and the action would be imperfect In several of the other forms it is a good, practical safety valve.

Wm Hartley in the same year (1857) about a month later, patented improvements in steam engine and steam boiler apparatus. He describes his improvements in safety valves as follows:

"A safety valve for steam boilers is made to open so as to discharge a volume of steam equal to the discharge of an *unobstructed passage* through the valve sit. This is accomplished in two ways:

First. By constructing a valve A, as shown in Fig 32, with a projecting flange, on which is situated a curved, external rim B, projecting downwards, the section of the said valve and rim being similar to the section of an inverted cup, as shown in Fig. 32. When the valve is closed, the external rim is nearly in contact with the valve sit or its bearing; but when the valve is opened by the action of the steam, the distance of the rim from the valve sit, or its bearings, is equal to the area of the passage in the valve sit, thereby discharging its maximum quantity of steam.

Second. I accomplish a full discharge of steam by making the projecting rim of a cylindrical form, and the valve sit, or its bearing, curved, so as to increase in diameter downwards. In this case, when the valve A is closed, the bottom edge of the rim B nearly touches the bottom part of the curved sit, or bearing, and when the steam lifts the valve, the space between the edge of the rim and the bearing increases in area, and thus effects a full discharge of steam. The rod E is weighted when placed below the valve, or loaded by a spring if above the valve. In both of these arrangements the valve will close when the steam pressure becomes reduced below the load on the valve."

Chares Beyer also, in 1863, patented a valve similar to the above. He claims a flange around the valve, commencing at the outer edge of the valve-facing, which flange is under-cut and concave in shape, and the concave side is towards the sit of the valve, which has also a flange upon it, commencing at the outer edge of the valve sit; but the upper surface of the flange is convex, and corresponds nearly

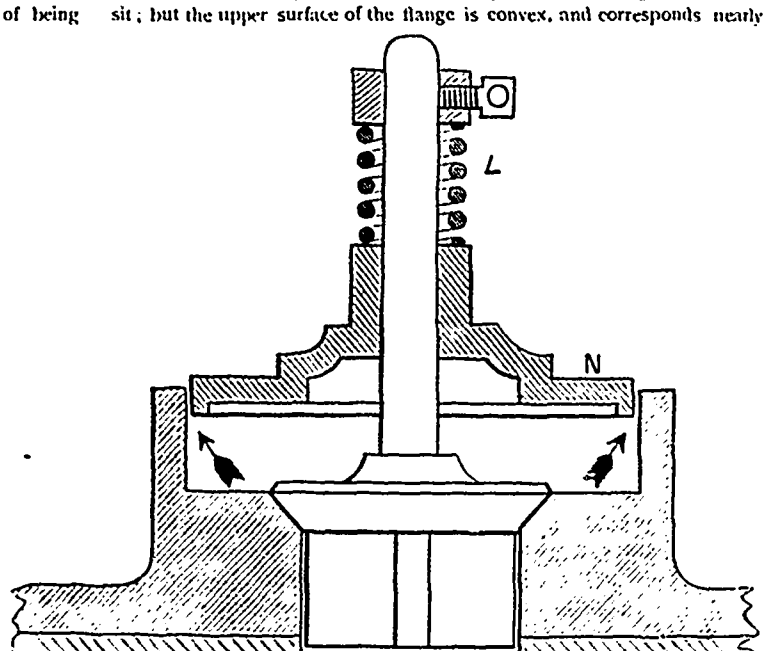


Fig. 29.—James Webster, July 14, 1857.

to the concave surface of the flange upon the valve. There is a slight space between the concave and convex surfaces of the two flanges, which diminishes towards the outer edge of the flange. When the steam begins to escape from between the surfaces of the valve, it gets between the concave and convex surfaces of the two flanges, and its force thus acts upon a larger area and reacts upon the concave surface of the valve and causes it to open to a greater extent than the ordinary safety valve.

In view of Ritchie (1838), Webster (1857), and Hartley (1857), there is in Beyer's device (1863) only a very narrow margin of novelty, if, indeed, there is anything beyond mere forms, wholly without effect upon the action of a safety valve.

In July, 1863, William Naylor patented and described a safety valve with a projecting, downward-turned lip, similar to Beyer's and to one form of Hartley's (Fig. 32), but lays no claim to its invention. He says: "By means of the curved, downward-projecting lip, I am enabled to avail myself of the recoil action of the steam against the valve for the purpose of facilitating the further lifting of such valve when once opened; but I wish it to be understood that I lay no claim to such recoil action, nor to the extension of the valve laterally beyond its sit.

Naylor's patent also contains two other devices: First, for compensating for the increasing resistance of the spring by the varying leverage of a bent lever, as shown in Fig. 34. Second for a supplementary piston valve, for indicating the pressure existing in the boiler at all times, whether the safety valve is closed or open.

The bent lever device is eminently practical, and affords one example of a way of making a practical valve, working upon the principle of automatically relieving the boiler from excessive pressure without a considerable

enlargement of the steam passage to the atmosphere from the valve sit, followed by a comparatively quick contraction of this passage, which con traction is called a stricture.

Fair examples of reactionary safety valves in America are the Crossby and Richardson, which are well known and largely in use.

Fig. 35 represents the Richardson valve. In this valve a disk valve or cover sits upon the inner edge of a cylinder shell or body, having guides

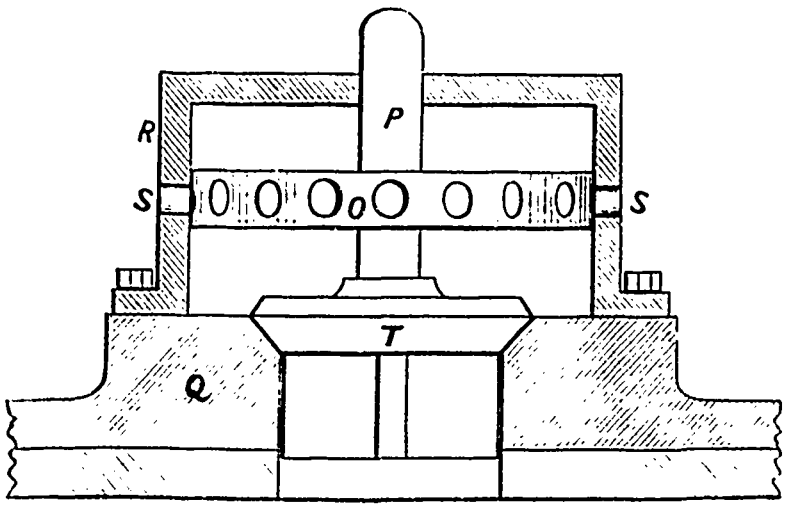


FIG. 30.—JAMES WEBSTER, JULY 14, 1857.

extending down into such shell or steam space, so far corresponding exactly to the ordinary safety valve in common use as before described. The end of the shell upon which the valve sit extends outwardly. The valve also extends outwardly from its sit, and downwards in the form of a lip, encircling the valve and relief outlet and overlapping the extended shell, and is brought so nearly to such extended shell at its edge as to form a very narrow opening to the atmosphere. These extended parts form an annular chamber. A helical spring is used to close the valve against the pressure of steam within the shell or body. The devices used to increase the lift of the valve, and give greater relief, are of such described parts as appear on the figure:

First. An annular lip C, outside and surrounding the valve B.

Second. The valve sit F.

Third. The relief outlet, shown by small arrows at lip C.

Fourth. An annular space or chamber D, formed by lip C and the extended shell E outside and surrounding the valve sit, the lip C overlapping the extended shell E slightly, and forming a very narrow annular opening from the chamber to the atmosphere when the valve is closed, but enlarging after the valve has lifted some distance from its sit.

Operation.—When the steam within the shell, or body, acting upon the whole face of the valve is sufficient to overcome the resistance offered by the spring, the valve will lift and the steam escape from the relief outlet under the valve into the annular chamber, and there expanding, and finding but a very small opening to the atmosphere, acts, but with diminished pressure, upon the additional surface presented by the overhanging lip surrounding the relief outlet, and again exerting force to overcome the resistance of the

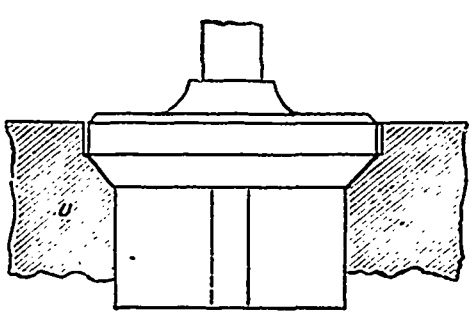


FIG. 31.—JAMES WEBSTER, JULY 14, 1857.

spring. The effect is that the valve will lift higher, but the amount of steam passing the relief outlet under the valve is increased before the annular opening at the outer edge of the lip is increased, owing to the over-lap, and the valve has to lift still higher and higher to give the necessary outlet to the steam entering the chamber from under the valve, until the extra force is counterbalanced by the increasing resistance of the spring.

The steam in the chamber, by being obstructed in its course to the atmosphere by the lip, interferes with the free escape of the steam under the valve.

At the test at the Washington Navy Yard, one of these valves had two springs so arranged as to exert their strength and force in opposite directions—that is, the lower spring holds the valve down against its sit, and the upper one lifts it from its sit, so that the valve proper will open at a pressure equal to the difference between the adjusted power of the springs. For example. The lower spring is compressed sufficiently to hold the valve down at 100 pounds pressure, and the upper spring compressed to exert one-tenth of that force in an opposite direction; that is, to raise the valve. The valve will then lift at 100 less 10=90 pounds pressure.

Fig. 36 represents a lock-up safety valve, with means upon the outside to lift it from its sit. These valves are made with either single or double springs, and without the lock-up arrangements. These valves also have an arrangement by which they can be retained in their sit whenever it becomes necessary to do so, such, for instance, as to apply the hydrostatic test to the boiler.

The excess obtained on these valves at 30 pounds pressure, was from ½ to 7 pounds, at 70 pounds pressure, from 1¼ to 3½ pounds. Areas exposed at 30 pounds, 0.869, 1.171, and 1.455 square inches; lifts, 0.15, 0.20 and 0.25 of an inch. At 70 pounds, 0.691 square inch; lift, 0.12 inch.

The records of the trial made upon these valves show that the excesses above 30 and 70 pounds were varying, and that in some instances none at all were obtained.

The Richardson safety valves are made with a solid cast-nickel ring. Fig. 37 represents the solid nickel casting used for the valve sit. The thread on the outside is for screwing into the base of the valve. It is threaded on the inside for the head of the valve, the contact is beveled at an angle of 45 to its center line of axis, and the metal, being so hard, enables the use of a very narrow faced joint, or contact, with no danger of its cutting. Its chemical properties prevent corrosion from the action of water, steam, fatty acids of oils, or saline matter in the water.

All valves are fitted with an adjustable screw ring, so that the popping point can be changed while steam is in the boiler, without breaking any joints. These valves are absolutely reliable in their action, prompt in opening and closing at the proper moment, and *fully sufficient in capacity* to relieve the boiler from any pressure in excess of the amount intended to be carried. Figs. 38 and 39 show the different areas of the ordinary and this valve.

The usual diameter of safety valves in use in the United States on locomotives is 2¼ inches diameter, and each boiler is fitted in duplicate. Fig. 40 shows the spring F, which is the vital factor of spring-loaded safety valves. These springs are carefully selected, and the greatest care is used in the coiling, tempering and testing of the same. They are nickle-plated, to protect them from rusting.

The points of bearing, top and bottom, are ball and socket, preventing

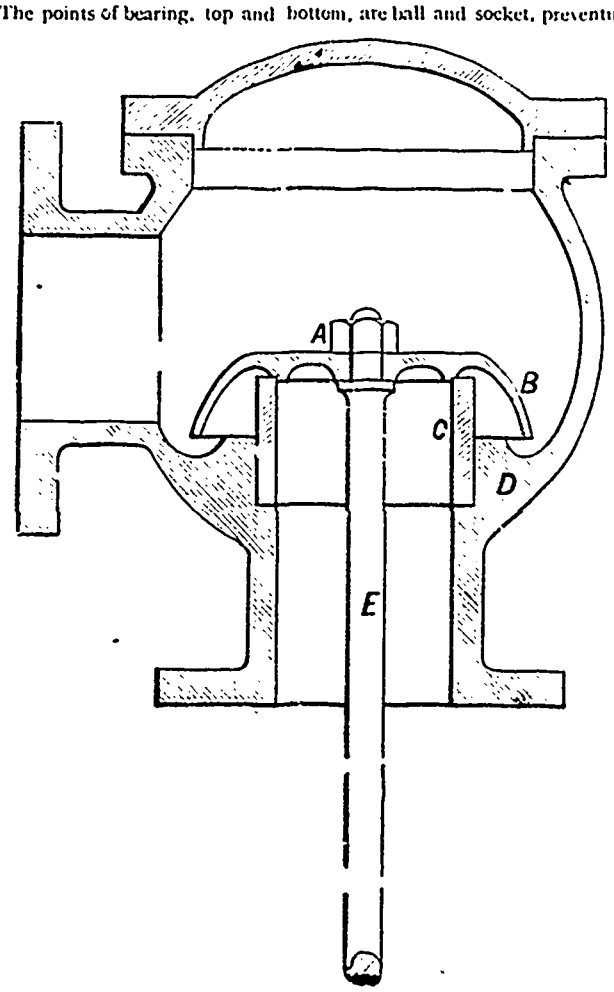


FIG. 32.—THE HARTLEY VALVE, AUGUST 19, 1857.

any tendency to tilt to one side and bind the spindle D, through which the pressure to hold the valve on its sit C is transmitted, and makes the valve thoroughly reliable.

The lip C' is adjustable. If the valve reduces the pressure in the boiler too much, loosen the set-screw L and turn the ring up a notch at a time, if it reduces the pressure too little, turn the ring down a notch at a time until the desired pressure is reached, and then turn down the set-screws L L. The notch is shown at K.

THE CROSBY SAFETY VALVE.

The sits of this valve are flat, and it is claimed that the sits do not wear

out or leak so readily as beveled sits, and *will never stick*. This valve is adjustable also, the point of opening can readily be changed while under steam by screwing the threaded bolt L at the top of the cylinder up or down.

The Crosby valve has a compound or annulus-disk valve sit at its periphery

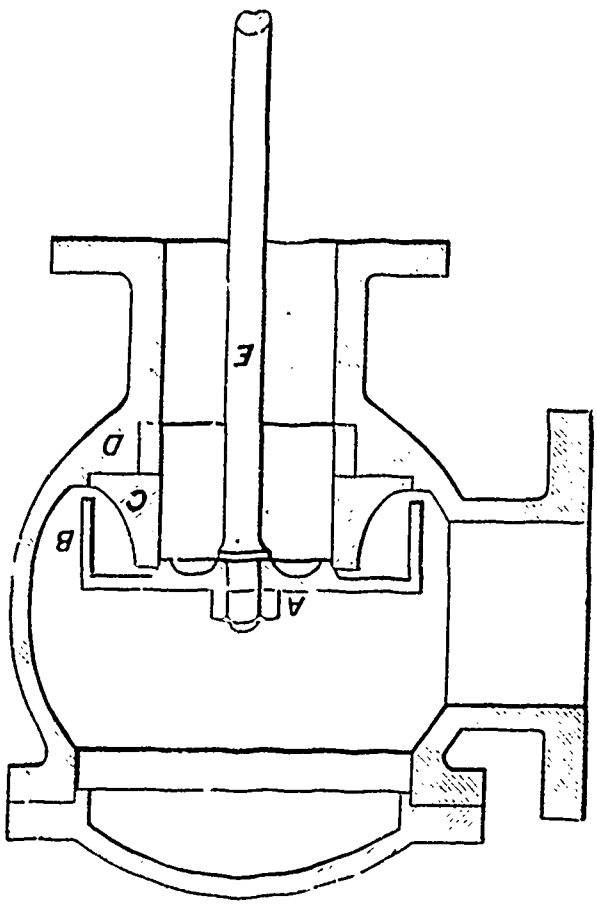


FIG. 33.—THE HARTLEY VALVE, AUGUST 19, 1857.

upon the edge of a cylindrical shell or body, and having guides projecting downward from the centre of the valve into a cylindrical chamber situated under the centre of the valve and inside of the space enclosed by the shell or body, and to which the steam has no access when the valve is closed. The boss, or chamber, is held in its position by radial arms connected with

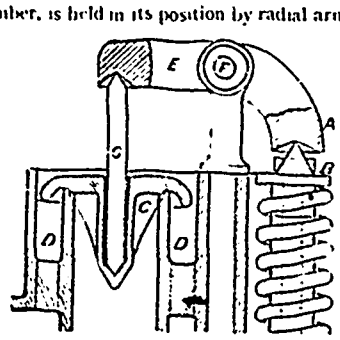


FIG. 34.—THE NAYLOR VALVE, JULY 21, 1863.

the shell. The upper face of such boss, or chamber, is arranged to come in contact with, and protect, a certain portion of the face of the valve itself from the action of the steam pressure, until the valve opens. Openings are made from this chamber, or boss, through the radial arms and shell, or

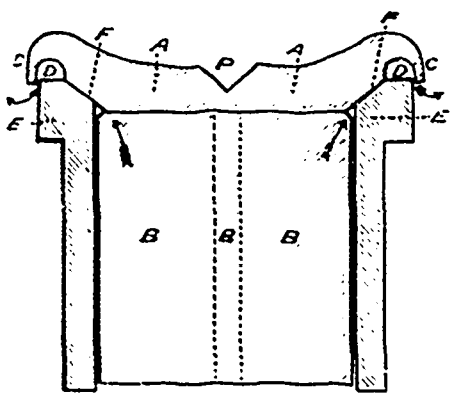


FIG. 35.—THE RICHARDSON VALVE.

body to the atmosphere, and a ring or sleeve is screw threaded to the outside of the body to regulate the size of such openings. A helical spring is used to close the valve against the steam pressure within the shell.

The devices used to give a greater lift to the valve are such boss or cylindrical chamber C C, with its upper face W W, smaller than the valve B B, and, as has been described, and as appears from the cut annexed so situated inside of the shell or body, that its upper face shall come in contact with and protect a portion of the face of the valve itself from the action of the steam pressure within the shell until the valve opens; and the small

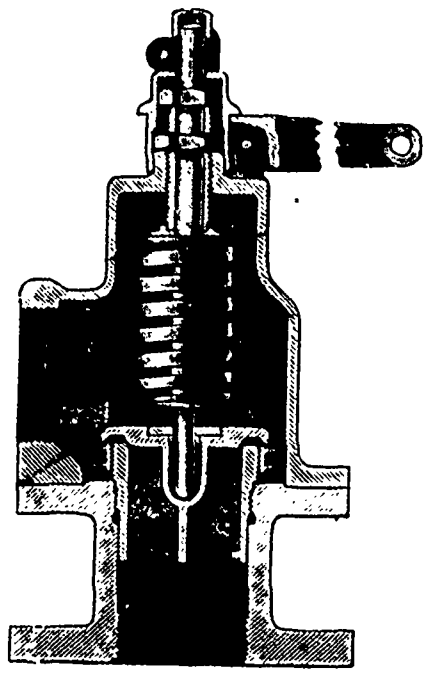


FIG. 36.—LOCK-UP SAFETY VALVE.

openings E E, from the boss, or chamber, through the radial arms and shell to the atmosphere. The size of these openings can be varied by the operator at will, but not by any action of the valve.

OPERATION.

When the steam within the shell, or body, acting upon that portion of the face of the valve not covered by the face of the boss, or chamber, is

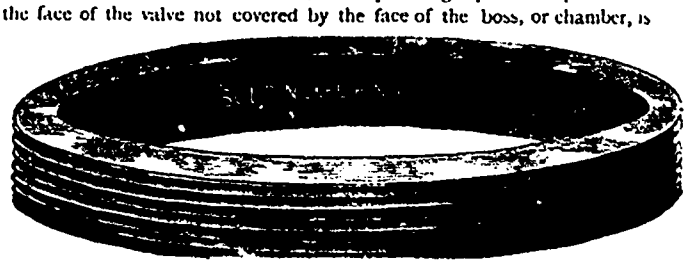


FIG. 37.—SOLID CAST-NICKEL RING.

sufficient to overcome the resistance offered by the spring, the valve will lift and the steam will escape from the relief outlet under the valve at its periphery into the atmosphere unobstructed, and no further use is made of it. At the same time that portion of the face of the valve itself which was protected by the boss, or cylindrical chamber, from the action of the steam pressure is uncovered, and the steam acts upon such surface with great

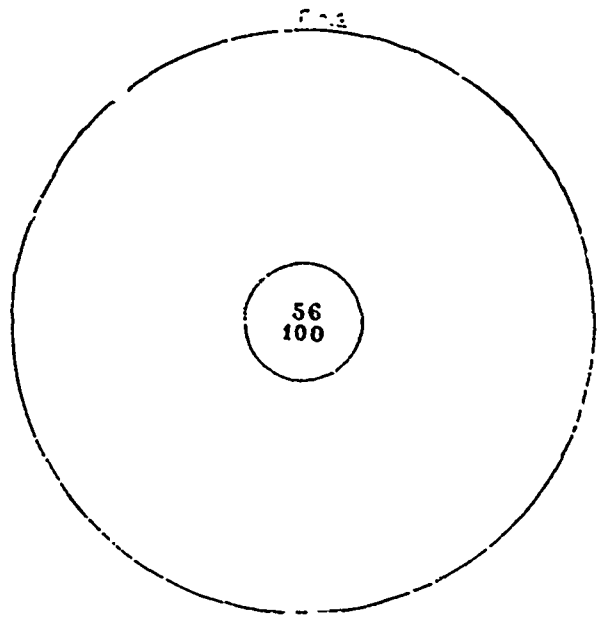


FIG. 38.—THREE-INCH COMMON SAFETY VALVE, AND THE AREA OF OPENING PRESENTED WHEN THE VALVE LIFTS FOR THE ESCAPE OF THE STEAM.

power also, and exerts a force to overcome the resistance of the spring. In lieu of changing this central area for every change of pressure required the pressure acting upon the fixed central area of the portion of the face of the valve so uncovered is reduced to the proper amount by the size of the openings from the boss, or chamber, at their outlet.

The effect is, that the valve will lift higher and the relief outlet is enlarged to any degree desired without the slightest obstruction to the free escape of the steam under the valve into the atmosphere.

The navy yard trials showed that the excess obtained on this valve at 30

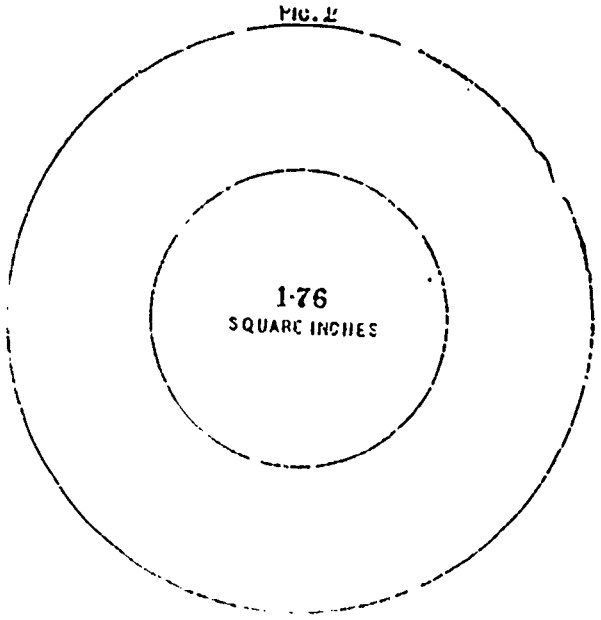


FIG. 39 - SHOWS THE NICKEL-SEATED SAFETY VALVE, AND THE AREA FOR THE ESCAPE OF THE STEAM WHEN THE VALVE LIFTS.

pounds pressure was from 2½ to 5¼ pounds; at 70 pounds pressure, from 3 to 5 pounds.

Areas exposed at 30 pounds, 1.257 square inches; lift, 0.12 inch; at 70 pounds, 0.729 square inch; lift, 0.07 inch.

These excesses were only temporary, and upon trial after readjustment no excess was obtained, but the range of pressure between the opening and closing points was about the same on all the trials; that is, if the valve made less excess, or none at all, it seated at a lower pressure.

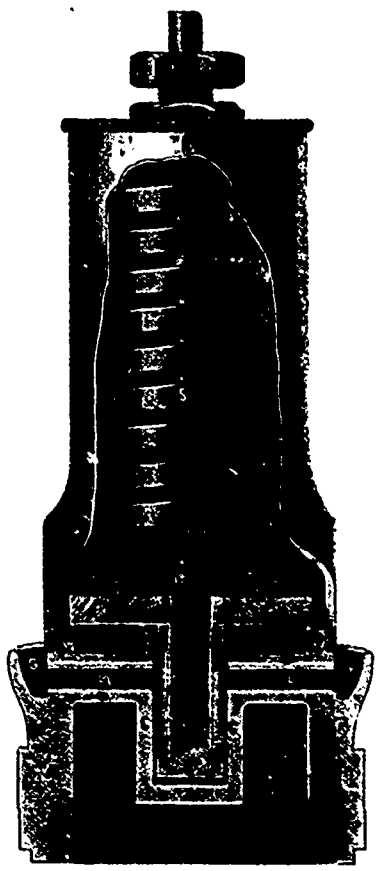


FIG. 41.—CROSBY LOCOMOTIVE "POP" SAFETY VALVE.

THE AMERICAN POP SAFETY VALVE.

This safety valve is provided with a second or movable head on the top of the valve proper, as shown in Fig. 42:

MOVEMENT.

H—Valve.

I—Inclined holes in automatic head G.

G—Adjustable automatic head on top of valve H.

S—Spring to return the head to its position after the valve has stopped blowing.

P—Cavity for the accumulation of steam to feed holes through valve H, and head G.

There are two series of holes drilled around the outer edge of these heads, for the purpose of reducing the amount of increased area.

First. The first series is drilled around the head of the valve proper and drilled at an angle of 90° and the sit of the same.

Second. The series is around the second or movable head G, and drilled at an angle of 55° with the holes in the head of the valve H.

Now, the movable head is placed in such a position upon the head of the valve H, that there is a small opening between the holes in the head of the valve H, and in the corresponding holes in the second or movable head G.

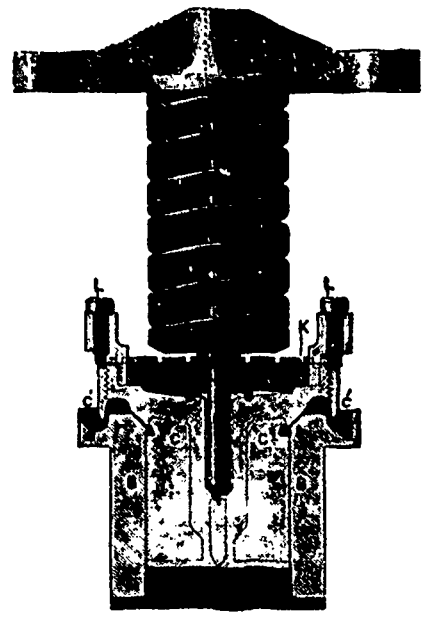
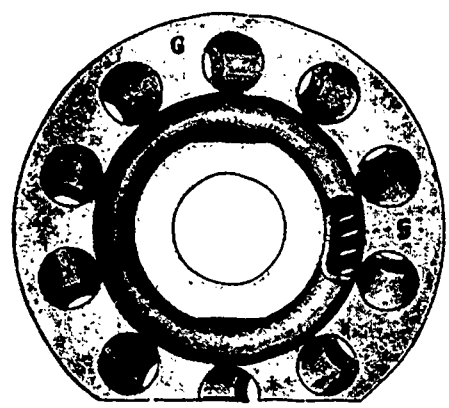


FIG. 40.—RICHARDSON'S OPEN LOCOMOTIVE "POP" SAFETY VALVE, WITH ADJUSTABLE SCREW RING.

It will readily be seen that the result of this device is simply this, that when the valve lifts from the sit to blow, the passage of the steam through the holes in the head of the valve H passes into the corresponding holes in the movable head G; and as the walls of the holes in the head G are at an angle



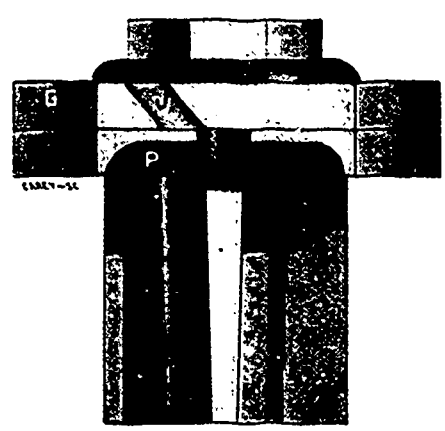


FIG. 42.—THE AMERICAN POP SAFETY VALVE.

of 55° with the holes in the head of the valve H, the automatic head G will be forced around in such a manner that the holes of the two heads will be directly in line with each other, the result being a decrease of increased area.

(To be Continued.)

T. W. Ness & Co., of Montreal, have secured the Canadian agency for the Zurich Incandescent Lamp Company, Switzerland.

The Hamilton Electric Light and Power Co. have recently installed a 1500 light alternating dynamo, complete, with transformers, made by the Royal Electric Co.

The Ball Electric Light Company, Ltd., 70 Pearl street, Toronto, report the following recent sales of their apparatus: Beardmore & Co., leather merchants and manufacturers, 6 h.p. Ball motor. Imrie & Graham, printers and publishers, 7 h.p. Ball motor; Potter & Co., furniture warehouse, 6 h.p. for running elevator. Toronto Engraving Co., 1 h.p. motor, E. Dack & Son, shoe manufacturers, 2 h.p. motor. All of the above in Toronto. Also the following automatic incandescent dynamos. D. Hibner & Co., furniture factory, Berlin, Ont., 80 light, 16 c.p., W. Shaw, tannery, Bracebridge, Ont., 40 light, 16 c.p., J. Bertrand, St. Hyacinthe, Que., 25 light, 16 c.p. Arc plants. Hawkesville Lumber Co., Hawkesville, Ont., 35 arc, 4 ampere, also 4 4 h.p. motor for arc circuit to same company. McGowan & Co., Oakville, Ont., 50 arc, 4 ampere, etc., etc.

THE ADVANTAGE OF LONG DISTANCE TELEPHONING.

In an interview with Superintendent Mallett, of the Bell Telephone Company, by a representative of the *Post-Express*, of Rochester, N. Y., the advantages of the long distance service were very clearly and concisely put.

In response to a question on the subject, he said: "Business men are availing themselves of its advantages to carry on communication that could not be done by telegraph. They can discuss questions and negotiate as though they were face to face. The metallic circuit in use on the long distance line conveys the message perfectly. Where one has a city telephone with a metallic circuit he can get a message from New York or Boston in his own office. But with the ordinary ground circuit, one living here could send a message to New York that would be understood, but he would not be likely to receive a distinct one in return. A new line has been opened to Pittsburgh, and it is now being extended to Chicago. There is a comparatively greater demand for long distance service in New York, Philadelphia and Boston than elsewhere. The greater population at these points does not account for it altogether; the value of the system appears to have received quicker recognition there. In the city of Rochester there is one firm that pays $75 to $80 a month for its telephoning, and another paid over $125 last month."

SPARKS.

Mr. Frederic Nicholls recently delivered an address before the Toronto Architectural Guild on "Interior Wiring."

A line of poles on Rideau street, Ottawa, recently gave way under the weight imposed on the wires by a heavy fall of wet snow. For a short time the electrical business of the city was badly tangled up.

The National Electric Lighting and Tramway Company, of Victoria, B. C., has just purchased a 200 horse power Edison railway generator and two complete car equipments of 30 horse power each of the latest single reduction type.

The carbon manufactory of the Brooks Mfg. Co., at Peterborough, Ont., was recently damaged by fire to the extent of $7,000 or $8,000. Within a month the company hope to have the building reconstructed. Fortunately they have a sufficient stock of carbons on hand to supply the demand in the meantime.

The new boat now being built for the C. & N. R. Co. by the Albion Iron Works at Victoria is to be equipped with electricity. The boat is to be wired throughout by the Edison Company, and the fixtures are to be very handsome and durable, and to be finished by the new process of coating with aluminum, which is proof against the action of salt water or steam. When finished it will be one of the most perfect boats on the Pacific coast so far as the electrical arrangements are concerned.—Vancouver *News-Advertiser*.

A stock company has been organized in Chicago for the purpose of introducing an invention which it is claimed, will eventually do away with the telephone girl. The invention is described as follows:—On the telephone shelf is a row of keys, five in all. They are marked units, tens, hundreds and thousands, the fifth key being the release key. The subscriber taps out the desired number on the key-board, which, registering on the machine automatically, connects the wire of the subscriber with that of the 'phone he desires to reach. The connection is made with the taps on the key-board. The subscriber wishing to place his transmitter and ear 'phone in connection with those of any other can do so by successively pressing the key which causes the circuit closer to move. If the man at telephone No. 288 wishes to place himself in connection with telephone No. 315 he will do so by pressing the key marked hundreds three times, then the key marked tens once and then the key marked units five times. His circuit closed is then in contact with wire terminal No. 315. The person at telephone No. 315 will take down his ear 'phone and the two are then able to converse with each other. The contrivance takes up a space of but 6x4x4 ins. The management of the Minneapolis telephone exchange does not believe the invention is of any practical use.

Please mention the ELECTRICAL NEWS when corresponding with advertisers.

SPARKS.

The Berlin, Ont., Gas Company have lately put in operation two new Edison incandescent dynamos.

A motion pending in the Toronto courts to quash the by-law passed by the Township of Etobicoke, granting a bonus of $20,000 to the Toronto and Mimico Electric Railway has been dismissed.

At a recent meeting of the shareholders in the Davenport Electric Street Railway Company, Messrs. Robert Jaffray, William Booth, Barlow Cumberland, Allan Royce, C. E., and B. E. Bull were elected directors. At a subsequent meeting, M. Frank Turner was elected president of the company, and Mr. William Booth vice-president.

James P. Wooley, Simcoe, Ira N. Vail, Township of Woodhouse, and Thos. E. Vail, Township of Townsend, Ont., have been granted a patent for Canada on a cut-off for electric machinery, consisting of a movable plate connected to one pole of an electric circuit in contact with a plate connected to the other pole of the circuit, an electro magnet supporting a weight connected to the movable in such a manner that it will break the contact between the two plates the instant the electro magnet is demagnetized.

The contract for the equipment of the Toronto and Mimico Electric Railway, exclusive of track, has been given to the Reliance Co., of Waterford, Ont., who are manufacturers in Canada of the Rae System. Single reduction motors will be employed. The power station will contain one Armington & Sims engine of the compound condensing type, 125 horse power, and the Rae station railway apparatus consisting of one 85 kilowatt generator, and the necessary appliances. The road will start from the terminus of the Toronto Street Railway company's lines on Queen street, and extend to the village of Mimico, and eventually to Long Branch, a total distance of about seven miles, running along the lake shore the entire distance.

The United States courts have granted to the Brush Electric Light Co., a perpetual injunction restraining the United State Electric Lighting Co., from using the double-carbon lamp, which was patented by Charles Brush September 2, 1879, and has ordered that testimony be taken of the amount due the Brush Co., for infringement of the patent