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VOL. X. MAY, 1900 No. 5.

MOUNT WHITNEY ELECTRIC POWER TRANSMISSION.

As being one of the latest and most interesting installations in the United States, we present some illustrations and particulars of the electric power transmission plant of the Mount Whitney Power Company. This plant was installed for the purpose of utilizing the waters of the Kaweah river, in California, for furnishing light and power to the cities of Visalia and Tulare and throughout Tulare county.

FIG. 1.—GENERATOR SIDE OF THE MOUNT WHITNEY POWER HOUSE.

The Kaweah river rises in the Sierra Nevada mountains, one of which, Mount Whitney, is over 14,000 feet above the level of the sea. The river is fed by the waters from these mountains and winds its way through the valleys, then down the canyon, over precipices and through gorges, to Tulare Lake, bearing the waters from a drainage area of 619 square miles. At a point distant about 45 miles easterly from the city of Visalia, named Oak Flat, at an elevation of about 2,400 feet above the sea level, a solid granite ledge crosses the river and forms a perpendicular bluff on the south side, as well as a natural dam of about 12 feet in height above a pool below into which the waters of the river flow, thus forming a splendid waterfall. A tunnel three feet wide and six feet high conveys the water to a flume which is 30,000 feet in length. The inside dimensions of the flume are 36 inches wide and 22½ inches deep. It has a uniform grade of 26.4 feet per mile, giving a maximum velocity of flow of seven feet per second. At intervals sand boxes and waste gates have been provided, so that any sand which might find its way into the flume during the period when the snow is melting can be easily disposed of before reaching the pipe. The maximum carrying capacity of the flume is 37 cubic feet per second. The flume terminates in a sand-box and overflow gate, at right angles to which an apron leads off to the penstock. This apron is equipped with gates which regulate the amount of water which may flow into the pipe, and also with iron racks which prevent the entrance of anything which might be floating in the water. The penstock is 6x8 feet and 16 feet deep.

THE PIPE LINE.

The pipe line extends in a straight line from the penstock to the power house. It is 3,500 feet in length, and has a perpendicular fall of 1,300 feet. It follows along on ridges the most of the way and passes down over some very steep pitches. Commencing at the penstock the pipe is 50 inches in diameter, but it tapers down to 24 inches in the first 50 feet. This acts as a funnel and gives the water an easy entrance to the pipes.

Then follows 2,100 feet of rivetted and 1,160 feet of welded pipe, from 24 to 20 inches in diameter. A portion of the pipe is at an angle of about 45 degrees, and much of it at angles from 25 to 30 degrees. The capacity, with 20 cubic feet of water per second, is 2,800 horse power to water wheels.

THE WATER WHEELS.

The power house is located about 35 miles from Visalia and is 30 × 50 feet, with an addition 12 feet square. The

FIG. 2. DOBLE ELLIPSOIDAL WATER WHEEL.

side of the building stands parallel with the pipe line and the water is led to the water wheels through passages of gradually decreasing area and with very easy curves. The water wheels are of the Doble ellipsoidal type and are solid steel castings, weighing about 1,400 pounds each, with 20 bronze buckets attached securely by means of two steel bolts to each bucket. A view of the Doble water wheel is shown in Fig. 2, while Fig. 3 shows a verticle section, with baffle-plates and tail-race. The steel centres are 44 inches in diameter, and the speed of the wheels is 514 revolutions per minute, giving a maximum capacity of 1,000 horse power each. The wheels are mounted directly upon the generator shafts, and the regulation is entirely by hand, aided by three annealed cast steel fly-wheels mounted on the opposite end of the generator shaft. These fly-wheels are 50 inches in diameter, 10½ inches face, and weigh 4,000 pounds. The water which is deflected downward by the cut-off device into the tail-race is received upon heavy cast iron baffle-plates and thence conveyed harmlessly away to the river. The wheels were manufactured by the Abner Doble Company, of San Francisco.

ELECTRICAL EQUIPMENT OF POWER HOUSE.

The electrical equipment consists of three Westinghouse three-phase alternating current generators, separately excited, slotted type, continuous winding armature, 450 k.w. each, 1,020 amperes, 440 volts, 7,200 alternations, with speed of 515 revolutions per minute. The illustration on first page is a view of the generators. The weight of each generator unit is over 40,000 pounds. Fourteen field poles are used, being separately excited by small direct current machines. The three generators give a normal capacity of 1,800 horse power. There are two belt-driven direct current generators of 15 k.w. each for exciters, which supply a current of 125 volts at a speed of 1,050 revolutions per minute. Each exciter has sufficient capacity to excite the two generators and is so located in the power house that it can be driven from either generator. There are four step-up Westinghouse transformers of 500 k.w. capacity each, of the oil-insulated, air-cooled type. These are three phase transformers of a primary voltage of 440, while the secondaries may be divided to deliver current at either 17,300 or 34,600 volts.

The switch-board consists of five marble panels all two inches thick and 65 inches high, four of them being 24 inches and one 36 inches wide, mounted on an iron frame. There is one exciter panel containing ammeters, two 3-pole single brake switches, two voltmeters, plug receptacles and pilot lamps. There are three generator panels, each containing one voltmeter, one ammeter, one voltmeter plug receptacle, one 3-pole quick-brake main switch, two field plug switches, one rheostat, synchronizer plugs and lamps and pilot lamp. The distribution panel contains two integrating watt-meters, three quick-brake double pole double-throw main switches, with interlocking device. From the generators and exciters all wires and cables are rnn under

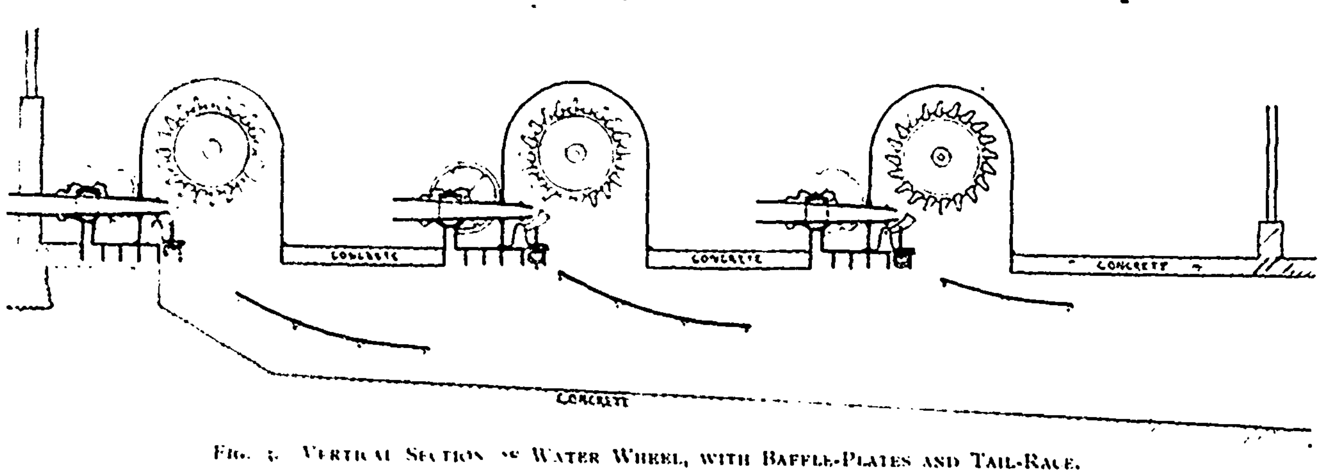

FIG. 3. VERTICAL SECTION OF WATER WHEEL, WITH BAFFLE-PLATES AND TAIL-RACE.

the floor in conduits to the switchboard and from there in same manner to the raising transformers. The method of distribution will be better understood by referring to Fig. 5. The secondary wires lead from the top of the transformers to the addition on the westerly side of the power house where the high-tension switches are arranged, by means of which the current is delivered to the transmission line. The high voltage current is then conducted to the lightning arrester house about 25 feet west from the power house. This building contains three lightning arrester units, each consisting of six choke-coils in series with the line and 30 arresters mounted on a marble slab.

THE POLE LINE.

From the lightning arrester house the current is delivered on to the transmission line, consisting of three medium copper wires No. 2 B. & S. gauge, arranged in in the form of an equilateral triangle, one wire being mounted at the top of the pole and the other two on a cross-arm of 3x4 Oregon pine. Eucalyptus pins, boiled in oil, are used to support the 7-inch tripple-petticoated glass insulators, which in turn support the transmission wires. The cross-arms are bolted to the poles and have a bolt through the ends to prevent splitting as well as to hold the pins in the arms. The top pin is secured by two nails driven through the iron band which is used to prevent the top of the pole from splitting.

About twenty-one miles from the power house the line is branched, one line going to Porterville, 21 miles distant, and the other via Visalia to Tulare, 20 miles distant. From the junction point to Visalia the wire is reduced in size to No. 5 B. & S. gauge and from Visalia to Tulare it is reduced to No. 6 B. & S. gauge. The total length of the line is 62 miles.

The poles are 26 feet long, 5x5 at the top and 9x9 at the bottom. For road crossings and in the towns their length is increased to 35 and 40 feet. The pole line is equipped with six pine cross-arms, 30 inches below the power circuit, for telephone purposes.

THE SUB-STATIONS.

Sub-stations have been established at Visalia, Tulare, Exeter, Lindsay and Porterville, each having a complete equipment of lightning arresters, high-tension fuse switches, step-down transformers, etc. Views of the interiors of the Visalia and Tulare sub-stations are shown in Figs. 8 and 9. The primaries of the step-down transformers are arranged with the coils divided in the centre for parallel or series connection, the same as the step-up transformers, for 15,000 or 30,000 volts, allowance being made for line drop. The secondaries have ten leads brought out, with terminal blocks, giving a range of from 1,930 to 2,280 volts, which is a valuable feature and has proven to be very satisfactory and useful, affording a ready means of changing the secondar. voltage to meet the requirements caused by changes in the proportions in the loads at the various sub-stations The transformers are of the Westinghouse oil-insulated, air-cooled type, in units of 50 kilowatts and 75 kilowatts, transforming from three-phase to two-phase, two transformers therefore constituting a "bank." The distribution of the light and power is at 2,000 volts, two-phase current.

The Visalia sub-station contains a 30-light arc machine for street lighting, driven by a 20 horse power induction motor, the incandescent lighting system being supplied direct from the 2,000 volt distribution and pole transformers to 104-volt secondaries. About 150 horse power is used from this station for lighting and a similar amount for operating induction motors for power purposes. In the Tulare station are two transformers of 75 k. w. each, and about 50 horse power is furnished to operate the water works and about 40 horse power for the local incandescent lighting system. The Lindsay station contains four transformers of 75 h. p. each, and furnishes 200 horse power for lighting and for

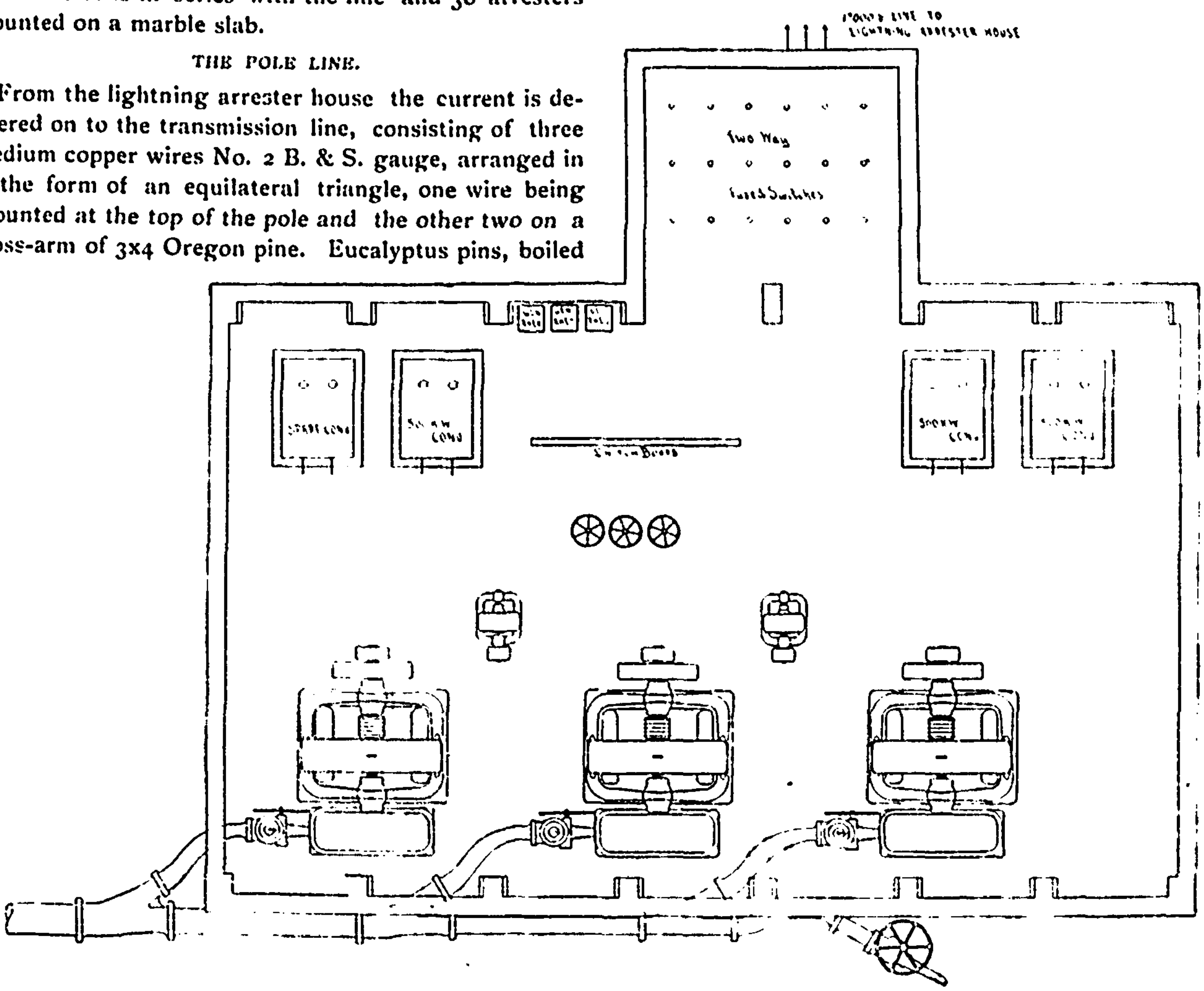

FIG. 4.—GROUND PLAN OF MOUNT WHITNEY POWER HOUSE.

operating pumping plants for irrigation, electric power having superseded steam and oil engines for driving the centrifugal pumps. The experience with the motors is said to have been satisfactory that many new installations are being contracted for. About 110 horse power is furnished by the Porterville station, in which there are installed four transformers of 50 k. w. each, also choke-coils and lightning arresters, the same as at the power house. In the Exeter station there are two transformers of 50 h. p. each.

The company has fixed the rate for current at $50 per horse power per year, delivered to the step-down transformers of the customer on his premises, measurement by wattmeter at transformer primaries.

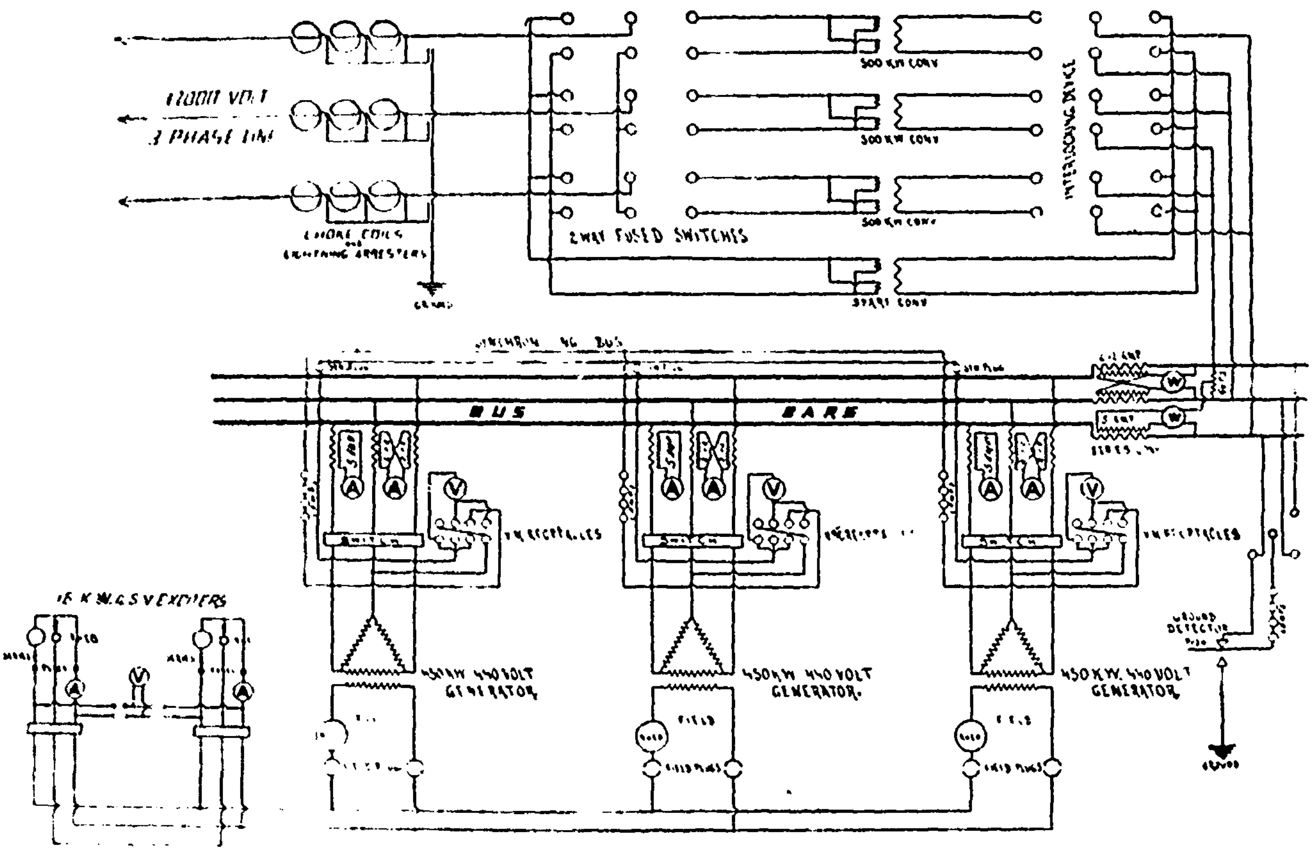

Fig. 5. General Wiring Scheme, Showing Method of Throwing Spare Transformer on to Either Leg of Transformer.

The interesting features of the above plant are the high head used, the method of mounting the water wheel, armature and fly-wheel on a single set of bearings, and the fact that it is the first large electric transmission plant to be equipped with ellipsoidal water wheels. The means adopted for throwing a spare transformer into service in the event of either of the raising transformers at the power house becoming disabled is also a unique feature.

The entire electrical equipment of the Mount Whitney transmission plant was furnished and installed by the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa.

USE OF LOW CANDLE-POWER INCANDESCENT LAMPS.

W. M. Stine, in Western Electrician.

This article has to do with some of the minor economies that should be considered by those operating plants which do house-to-house lighting. Abroad it is customary to use for such lighting lamps of 8 or 10 candles, while in this country the usual practice leads to placing candles or even higher illuminating powers indiscriminately on all circuits without proper consideration for the service expected from them. The life of the lamp, too, is a consideration that is given much weight, the tendency being to place stress on considerable length of life, without regard to economy of operation.

When it is necessary to push house-to-house lighting on meter rates to obtain a paying station load and a sufficient return from a line, there is encountered a large class of patrons who are not able to use electric lighting in their homes unless it can compete closely with gas. The convenience of the electric light is conceded, but the persons to whom reference is made are not in position to pay for it. This class of business is desirable where the houses are near together and a sufficiently large number of patrons among them can be secured.

The average station manager pays too little attention to the satisfaction which his service is giving the small consumers; he is satisfied when the house is wired and the lamps are in place and the voltage well maintained. Then, again, a 16 or 25-candle lamp requires more energy to operate it, and the position is thoughtlessly taken that such lamps will yield larger monthly bills. On the part of the patron, however, after the novelty of the service has worn off, in the course of a few months, the amount of the lighting bill becomes of more consequence than the convenience of the service. Gradually a lamp is dispensed with in the hall, and others where least needed, and then, one lamp after another being replaced with oil or gas, the patronage of electric lighting is finally lost.

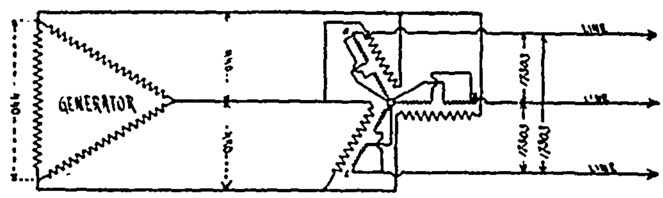

Fig. 6.—Connections of the Step-Up Transformers.

This small house-to-house business can be made to pay and will succeed if the management is sufficiently enterprising. At the very outset, however, it must be conceded that the electric light bill must not greatly exceed an equivalent gas bill. The second concession must be that the patron's house shall be well lighted. In order to accomplish this, small light units are to be used operated at a *high efficiency*. *In a small hall, for* instance, a four candle-power lamp will yield sufficient illumination, and its maintenance will prove such a small item that patrons will keep lights of this size continuously lighted. Similarly, such small lamps can be used in closets, the cellar, and many places where but little light is needed. In this way the halls and passageways about the house will be well lighted and cheerful instead of dark and forbidding, as is usually the case in an electrically lighted house.

But it is especially in the living rooms that attention should be given to the size of the light unit. Here, too, the question of the quality of the light is of as great importance as its intensity. In many cases a 16-candle low-efficiency lamp is used, which proves a poor and an

FIG. 7.—POWER HOUSE, POLE LINE AND PORTION OF FLUME.

expensive light for reading from the fact that it yields a very yellow light. Then, too, in chandeliers, two or three 16-candle lamps are often used where equally good diffusion of the light and sufficiently intense illumination could be obtained by replacing these lamps with others of eight or ten candles.

Coming to the main question at issue, economy and satisfactory service are secured for the patron by operating the lamps at a high efficiency. In spite of all that has been written on the subject, buyers of incandescent lamps still insist on great length of life. Though desirable in itself, in the present state of the art it should not be insisted upon.

An extreme case will be taken as an illustration. For reading purposes a 16 candle power light source is required. This *admits of sufficiently intense illumination* for comfortable reading at a distance of 7 or 8 feet. Bearing in mind that lamp-makers are obliged to gauge their product to a low efficiency standard to meet the demand for long life, the lamp in question will be considered to be operated at a much higher efficiency than its rating, which, it must be remembered, is in a sense arbitrary; and in this way one secures the desired whiteness of light and effects a great economy in its operation. By using a nominal 8 candle-power lamp at 50 volts on the circuit in question and operating it at a higher voltage there results:

	Volts.	Watts.
Lamp burning at 8 candles requires......	50	28
Lamp burning at 13 candles requires.....	55	34
Lamp burning at 15.5 candles requires...	56	30

If this lamp has replaced a nominal 16 candle power

FIG. 8.—INTERIOR OF VISALIA SUB-STATION.

one at 55 watts, when it is operated at 55 volts and yielding 13 candles of white light it will prove as effective as the displaced yellow lighting. In point of economy the lighting is now done for 62 per cent. of the usual cost, or 23 watt hours are saved each hour it is in use. Taking the by-no-means uncommon meter charge of 0.02 cent for the watt hour, this saving for each hour amounts to 0.46 cent. At a cost of 20 cents for lamp renewals the cost of the lamp would be saved in 44 hours of use. It is well known that lamps operated at a high temperature will blacken quickly and rapidly lose in candle power. This is especially true of a black filament; but if a well flashed lamp of low emissivity and bright gray color of the filament is selected, thus operating it will give a useful life of at least 300 hours, though the writer has had some lamps to show a record of 500 to 800 useful lamp hours, when operated at this excess in pressure, before showing too great candle power drop.

Taking 300 hours, however, as the basis for renewals, the saving will pay for the renewal and leave a balance of $1.15 and for better light service. But it is possible

FIG. 9.—INTERIOR OF PORTION OF LINDSAY SUB-STATION.

to operate the lamp at 56 volts, thus getting the full 16 candle power equivalent, the cost in this case being about 65 per cent. of the normal 16 candle power lamp.

This matter is one which calls for the exercise of intelligent care on the part of the manager of the plant. Some makes of lamps would not give good results under this treatment. It is emphasized that the filament must *be well flashed and have a bright gray and polished appearance*, and the exhaustion of the bulb must be thorough.

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Amendments to the Conmee Bill.

RECENT events in the Ontario Legislature have been fraught with more than usual interest for the electrical fraternity, inasmuch as several amendments to the Conmee Bill, passed at the session of 1899, were proposed. Some of the amendments were desirable, namely, those intended to improve the working of the Bill; some others, which changed in important respects the principles of the Bill, were objectionable. The Legislative Committee of the Canadian Electrical Association therefore felt called upon to take action to prevent the possible destruction of the usefulness of the Act, while, at the same time, it was prepared to aid in making the Act more workable. The Conmee Bill was attacked or affected from several directions, first, the Graham Bill; second, Mr. J. J. Foy's Bill; third, Dr. Bridgeland's Bill; and fourth, Mr. Lumsden's Bill. From the outset it was evident that the principal Bill was the Graham Bill, which contained some favorable and some unfavorable features. No purpose would be served by going into the details of the various clauses which would have affected the principles of the Conmee Bill; suffice to say that the objectionable features of the Bill were successfully opposed by the Legislative Committee, while, at the same time, the Committee supported other features of the Bill. The final outcome was the adoption of the following amendments, namely, to give municipalities the option of making the principal and interest of their debentures payable in equal annual instalments, as well as of making the debentures payable by means of a sinking fund, as in the original bill; to allow municipalities three months, instead of one, to withdraw from their offer or reject an award for the taking over of a plant; to make it optional for a municipality and a company to agree on a single arbitrator other than the official arbitrator. These amendments, it is admitted, will improve the workableness of, and facilitate procedure under, the Conmee Bill. The provision to allow municipalities three month's time to reject their offer or an award will place corporations in a position to submit the question to a vote of the municipal electors. Mr. Foy's Bill proposed to exempt the city of Toronto from the operations of the Conmee Bill. This measure was defeated in the Municipal Committee. The object of Dr. Bridgeland's Bill was to give authority to municipalities which develop water powers to dispose of surplus current for furnishing power. This was in part opposed by the Legislative Committee. The Legislature finally accepted Dr. Bridgeland's Bill, with some modifications. The design of Mr. Lumsdem's Bill was to repeal the Conmee Act, but its reception was not favorable, a second reading being unanimously refused in the House.

Reverting to the Conmee Bill, the feeling of the members of the House seemed to be that the legislation had not been given a fair trial, and that it would be unreasonable to alter the vital principles of the Bill until this had been done. It is a matter of congratulation that the Legislature has again approved, with practical unanimity, of the justice and fairness, both to municipalities and companies, of the principles of the Conmee Bill. The opposition encountered can scarcely be considered as antagonistic, inasmuch as the author of the Graham bill pronounced himself to be in sympathy with the leading principles involved in the Conmee Act. He frankly stated that the object of his Bill was to improve the working of the Conmee Bill and to make certain parts of it more clear. Nor can it be said that the members of municipal corporations are generally opposed to the measure. The municipal authorities apparently believed that its operation could be improved, but they did not seek to oppose the Bill itself. It is possible that in the future experience may suggest further amendments which may be made with advantage to all concerned. It might be pointed out that it is manifestly in the interests of electric lighting companies, not to place obstacles in the path of the Conmee Bill, but as far as possible to assist in facilitating its proper working, for, while the valuation clauses of the Bill will give the companies merely the barest actual value for their plant, and that without profits, yet, in the event of a municipality purchasing, that is better for the companies than leaving their property exposed, as under the former law, to ruin without compensation. Municipalities are not showing antagonism to the Conmee Bill, and nothing can be accomplished by companies pursuing a policy of antagonism to the municipalities. When a company is approached by a municipality with a view to the purchase of its plant, we believe it is advisable to deal with the offer in a fair, business-like spirit, and to throw no technical obstacles in the way of an amicable and equitable arrangement.

The electric lighting interests of the province are deeply indebted to the Canadian Electrical Association for the attention it has given to the legislation in question. The Legislative Committee has now become an important section of the Association. Although the work of this committee has been accomplished within two years, yet in this brief period legislation has been enacted which, while it does no injustice to municipalities, prevents the property of lighting companies from being exposed to confiscation. The benefits of the efforts of the Association do not accrue to its members only, but every lighting company in the province is placed under its protection. The Association is, therefore, deserving of hearty support.

Electricity in Mining.

IN ITS application to mining purposes electricity enters upon perhaps the most exacting and varied field which it is possible to conceive of, as all classes of transportation and haulage make their very exacting demands, and the applications to lighting, power for fans, drills, compressors, pumps, cutters, etc., are certainly wide enough to provide scope for all classes of apparatus. If, then, in this comprehensive field of application there still remain a few demands which electricity does not fill in an entirely satisfactory way at present, the reason will probably be found in the fact that these applications have been somewhat neglected by an art which has had such tremendous fields open to it in other directions. However, the fact remains that within a few years nearly every application of power to mining work has been successfully met by electric power, and a review of the situation at the present should prove to be both interesting and instructive.

The field invaded by electric power had been held, up till its advent, by steam and compressed air. The steam engine being a prime mover, still holds its place for developing the power, and must of necessity continue to do so unless superseded in certain cases by water wheels or gas engines, but in the transmission, distribution and application of the power developed by the prime mover, the steam, compressed air, and electricity are directly comparable. Steam distribution will obviously only be used where steam is the prime mover, while in the case of water power or gas the distribution will be by means of air or electricity. The question of gas engines for power generation in certain localities where the cost of coal is excessive is receiving attention, owing to the better heat efficiency of the gas engine and the value of the by-products of the gas manufacture. But in most mines economy is not the first consideration. Even in this case, however, the obvious advantages of electricity will render its use for lighting almost imperative.

The power demands for mining purposes may be generally grouped in four divisions, lighting, traction and haulage, power for fans, pumps, etc., and for drills and cutters. So far as lighting is concerned, no question can arise as to the superior advantages of electricity, its flexibility, safety in gassy mines, coolness, and freedom from flame and simplicity of transmission rendering it incomparably better than any other form of illuminant. With regard to traction and haulage, its only rivals are that ancient motor, the mule and cable traction. The first will probably always find a place in the workings in the vicinity of the faces being operated upon, while the rope and electric traction compete for the haulage of trains in the tunnels and outer works. Without dealing in detail with the advantages of electric over rope haulage, it may be pointed out that in the modern mine the former is almost exclusively occupying the field, except in cases where excessive grades render cable traction a necessity, and even in these cases electric motors are available for driving the cable drums. It is in its application to the general power demands for pumps, fans, hoisting, etc., that the flexibility and readiness of application of electric power becomes overwhelmingly apparent, allowing as it does the establishment of motors in out of the way places, and permitting its use for temporary demands without excessive installation costs, and also the ability to manipulate the apparatus from a distance is often of great value. No better illustration of the use of electric power for these purposes can be had than that afforded by an inspection of the camp at Rossland, where power is supplied from a distance of thirty-one miles by the West Kootenay Power and Light Company, and applied by means of about three thousand horse power in motors to the mines in the vicinity. Among the most striking applications in this camp is that for hoisting. Several hoists are in operation, the largest being driven by a three hundred horse power motor, raising ore from a 750 foot level. The motor is a three phase induction machine, directly connected to a double drum hoist capable of raising eight tons at a speed of 700 feet per minute. In connection with the same mine a compresser is driven by a 400 h.p. three phase synchronous motor. In other mines in Rossland similar but smaller machinery is used for the same and many other purposes, and the regulation on the lighting circuits is remarkably good when the effect is considered of so large a motor load with such variable demands as hoisting at the end of a thirty-one mile transmission line.

It is in the use of electricity for the operation of drills, coal cutters, etc., that questions may arise as to its value as compared with other powers. So far as the transmission is concerned, it still retains its superiority, and also as regards its flexibility and general simplicity, but, although in electric drills great advances have been made since their first application, the air drill still holds its own. It should be remembered, however, that not all of the favor with which the air drill is regarded is due to its superiority as a mechanism, but to the personal consideration that the exhaust from the drills furnishes fresh air to the workings, which it is practically impossible to obtain in such places by the general ventilating system. Further than this, consideration must be paid to the conservatism of the miner who is used to the vagaries of the air drill and who does not generally relish the acquiring of any fresh knowledge of newer apparatus, especially when it does not add to his comfort under conditions which are trying at the best. The electric drills in use may be divided into rotary and reciprocating types. The first, by reason of the direct application of motors, appears to present fewer difficulties in construction, while the latter, in attempting to imitate the percussion drill by the direct attraction of solenoids, introduce trouble of its own which it may be safely said have not been overcome up to the present. Again, the more successful of the latter class require the use of special electrical generators giving suitable current waves which cannot be used for the general power distribution. It short, the drilling appears to be largely in the hands of the air drill at the present time, in spite of many attempts to displace it, and in view of past experience the outlook is not at present very hopeful for electric drilling. As regards coal cutters, which are of considerable variety, electricity, owing to its flexibility and simplicity, can be very readily applied with success, and failures of the cutting apparatus, which have been pretty frequent in the past, cannot be laid to its charge. Several successful types of electrically driven cutters are at present in the market, and as one machine with two operators will displace from twenty to thirty men on the coal face, these will inevitably be more generally applied. The chief objection which is made to the use of cutters is due to the fact that, with the methods of laying out the coal faces which are adopted for hand cutting, machine cutting brings down the coal in such quantities that it cannot be carried away quickly enough, thus limiting the possible output of the machine.

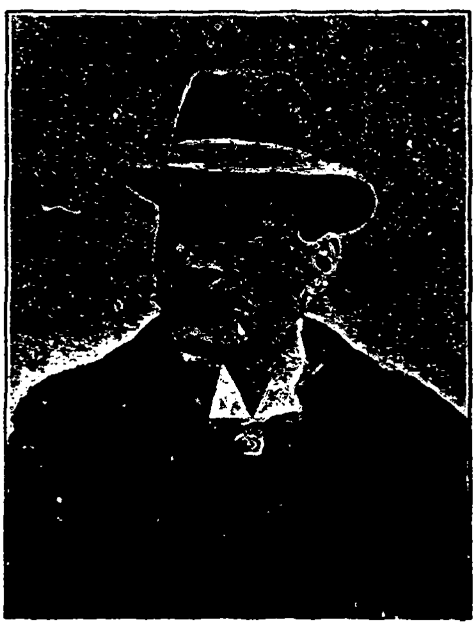
The most desirable system of generation and distribution of electricity will obviously be one which will lend itself best to the general requirements, and as it may not be possible to meet each of the separate demands in the best manner with one system, a compromise may have to be made, giving first consideration to the most important. For flexibility, an alternating system will appeal to the engineer in most cases, and owing to improvements in motors operated on this system, every requirement for mining work can be met with the exception of traction and some forms of drills. At the present direct current haulage holds the field, chiefly because the alternating motor has not been designed to meet the conditions imposed by mining traction, and also because the phased currents adopted require a double trolley line, which in the narrow and low tunnels would be prohibited, from its complication and danger. The latter appears to be the greater difficulty, as the application of alternating current motors to traction purposes appears to be solved for surface tramways, and the special application to mining work should present no insuperable difficulties. In many cases a direct current plant and distribution (which will be suitable for all purposes) can be used where the distances are not great and where no motors are to be located in gassy parts of the mines, but in general the low distribution voltage imposed by mining work heavily handicaps the direct current. In any case, for all mining purposes, except traction, the alternating current motor is more simple and reliable than the direct current, chiefly owing to the fact that no commutator is required which may flash, become dirty and require cleaning, which no mining motor ever gets. It appears probable that the alternating current systems will prevail finally for all purposes, but at the present a composite plant giving alternating and direct currents appears to be necessary if electric traction be required. This, however, is not so complicated as it looks, for with double current generators in the station either direct or alternating current can be had without complicating the plant. As regards the distribution of power, owing to the adverse conditions which prevail in mining work underground, a potential of more than 270 volts is not advisable on trolley wires which are within possible reach or on motors and other appliances which are to be handled. Owing to the dampness and presence of destructive minerals in the water, which is generally in evidence, insulations are rapidly corroded unless thoroughly protected, and it appears advisable in many cases to adopt bare wires thoroughly insulated from ground and each other by non-corrodable supports for the low voltage wiring, and armoured cables laid in dry places and out of reach for the transmission lines. The use of iron piping through which the cables can be drawn is usual in shafts and places where injury might occur through falling materials. In gassy mines safety cables are sometimes used which are designed so that the circuit is opened at the switchboard in case the cable is cut by falling rocks, so that no arc is formed in the mine. These generally require some form of supplementary circuit, which is objectionable, and it appears that ordinary concentric cables should meet the conditions of safety when it is considered that it is almost impossible to cut one of these without short-circuiting the cable, which would open the circuit-breaker in the station. In gassy mines, of course, gas tight or oil switches are used, and machines with commutators present more elements of danger than those without.

Summing up the advantages and disadvantages of electricity, steam and air, it may be said that steam distribution and utilization is expensive to install and maintain, is inefficient by reason of radiation and condensation, requires provision to be made for exhaust steam, heats up the mine, and rots the timbering. Air transmission and utilization of power is greatly superior to steam, and is generally used, but pipe lines are expensive to install, their deterioration is great, and there is not the requisite flexibility to meet the temporary character of the installations in the workings. Further, both of the above systems must be supplemented by an electric lighting plant. Electricity for mining purposes possesses in a remarkable degree the necessary flexibility and adaptability to meet the conditions. Maintenance is small, the attendance required is slight, and the same plant is used for the lighting as for the power requirements. The drill situation, however, is not altogether satisfactory, but the time for development of that particular application has been short, and there is good reason to think that the advantages of electric power for all purposes will soon improve that application and make it thoroughly satisfactory.

MR. JULES BOURBONNIERE.

The features of Mr. Jules Bourbonniere, manager and secretary of the Imperial Electric Light Company of Montreal, are portrayed on this page. Mr. Bourbonniere graduated with distinction from the Catholic Commercial Academy in Montreal in the year 1884, and immediately thereafter engaged as bookkeeper with the firm of Mailloux & Barsalou, wholesale hardware, Montreal, which position he occupied for four years. He then became manager, for two years, of Alfred Truteau's biscuit factory, and after spending two years as secretary-treasurer of the Farnham Beet Root Sugar Company (Baron Seillieres) at Farnham, Que., undertook the management of Israel Charbonneau's sash and door factory at Mile End, a suburb of Montreal.

In May, 1894, Mr. Bourbonniere entered the services of the St. Jean Baptiste Electric Company, of Montreal, as chief accountant and secretary. When the St. Jean Baptiste Electric Company was re-organized, in December, 1895, he was entrusted with the dual functions of manager and secretary of the new organization,



Mr. Jules Bourbonniere.

called the Imperial Electric Light Company, which position he still retains. The above company, judging by its annual dividends, is prospering financially, and claims to have a monopoly of commercial lighting in Eastern Montreal. Mr. Bourbonniere is only 31 years of age. He is married, and has a family of three future electricians.

It is whispered that Mr. Bourbonniere has been offered the management of a large water power plant. We shall be pleased to learn of his continued success.

NEW INCANDESCENT LAMP.

Edison has brought out a new incandescent electric lamp for high tension currents. It is made of a mixture of rare earths in a porous form, with carbon dust. The current, under the high pressure, leaps from particle to particle of the carbon dust. The earth used is thoria or zirconia, and the whole is dipped in a solution of acetate of thoria, so as to make a coating which shall incandesce brightly when the whole filament is brought to a high temperature by the action of the current. He also makes filaments by impregnating a thread of cotton wool, carbonising it, and then thickening the coating of oxide on it.

COST OF ELECTRICITY IN BUILDINGS.

It is generally assumed that electricity can be supplied to buildings more cheaply than it can be generated by isolated plants, but that this is not always the case is shown, says the Engineering Magazine, in a carefully prepared paper read before the American Institute of Electrical Engineers by Mr. Percival R. Moses.

Mr. Moses has collected information from more than a hundred buildings of various sizes and types, and from these he has selected those from which the information was furnished with such a degree of detail as to render the conclusions reliable. The buildings selected include hotels, office buildings, loft buildings, department stores, and apartment houses, all in the city of New York, and since liberal access to the books of the establishments was permitted the data are of much interest.

In the investigation of the buildings the hourly variations in the demand for light and power were plotted in the form of curves, and in each case a proportional allowance made for depreciation, interest, and other fixed charges. A typical building was taken in each case, and as these cases include actual records of the cost of supplying the same buildings, under the same conditions, with electricity, both from their own isolated plants and by the central station, it certainly appears as if the comparisons have been made upon a fair basis.

In considering the isolated plant it must be remembered that in nearly, if not all, such buildings a steam power plant must be maintained in any case, or at least steam must be used for heating, and if the steam power does not provide sufficient exhaust steam to warm the building, live steam must be used. The installation of an isolated electrical plant is therefore only a partial increase in operating expense, in such cases, and not so great as it would be if the entire power plant had to be placed solely for the operation of the electric machinery.

We give here only the conclusions which Mr. Moses draws from each building considered by him, and the full data in each case will be found in his original paper. Taking a table which Mr. Moses has prepared for buildings using approximately from 825,000 kilowatt-hours per annum down to 40,000 kilowatt-hours, he shows that the costs per kilowatt-hour for isolated plants are as follows :

Large Hotel	1.66 cents
Small Hotel	2.45 "
Apartments	4.70 "
Department Store	2.85 "
Small Store	4.10 "
Large Office Building	4.37 "
Small Office Building	5.06 "
Loft Building	2.60 "

When it is understood that the charges by the central station company, taken from the published reports, are, on an average, 10.6 cents per kilowatt-hour, and that the cost of production is about half this, it appears that under existing conditions in New York the private consumer can generate electricity at about the same cost, or even less cost than the central company, and that there is a manifest economy in the installation of the isolated electric plant.

The Lachine Rapids Hydraulic and Land Co. has within the last three months installed four generators from the works of the Canadian General Electric Co., Peterboro. These will increase the capacity of the plant by 4,000 h. p. The Lachine Company have recently made some changes in the method of driving the exciters at the power house, they now being driven by independent wheels.

THE GAS ENGINE VS. THE STEAM ENGINE.

A LEADING manufacturer of both gas and steam engines holds the opinion that a correct answer to the question, what is the comparative cost of operating a gas engine and a steam engine of equal power, involves a special solution for each individual problem. He says: Considered solely as a machine for converting the total energy of the fuel into mechanical work, the gas engine is far the more efficient. There are gas engines in operation which transform over 25 per cent. of the heat in the fuel into useful work, while in the very best recorded performance of the steam engine barely 14 per cent. of the energy in the coal burned has been thus accounted for, and in the average steam plant, not to exceed 5 per cent. There are many small plants, consisting of common slide valve engines, with uneconomical types of boilers, in which less than 2 per cent. of the energy of the coal burned is converted into mechanical work. At the same time it must be remembered that a given number of heat units in the form of fuel suitable for use in a gas engine costs more than an equal number in the shape of coal or other ordinary fuel suitable for burning in a common boiler furnace. As a general proposition it may be assumed that in a plant which operates continuously the item of fuel alone will be somewhat greater for the gas engine than for an improved type of modern steam engine, except possibly in the case of an engine running on producer gas. When the service is of an intermittent nature, or the power is required only for a comparatively short time each day, this difference in favor of the steam engine becomes less, and may even become a balance in favor of the gas engine, for the reason that in the gas engine plant there are no 'stand-by losses,' i.e., radiation and leakage when standing idle under full steam pressure, and coal burned in banking fires and raising steam. With the gas engine the fuel expense starts and stops with the engine. But the fuel cost is only one item in the cost of producing power. One must consider the value of the additional space and buildings required for a boiler plant; the cost of a stack; depreciation, repairs and insurance on a boiler plant. The gas engine has a field of its own which cannot be occupied by the steam engine, and there is no immediate prospect of the gas engine seriously encroaching on the legitimate field of the steam engine.

The Sherbrooke Gas and Electric Co., Sherbrooke, Que., are increasing their station capacity, and have placed an order with the Royal Electric Co., of Montreal, for a 500 k.w. S.K.C. two phase inductor type generator.

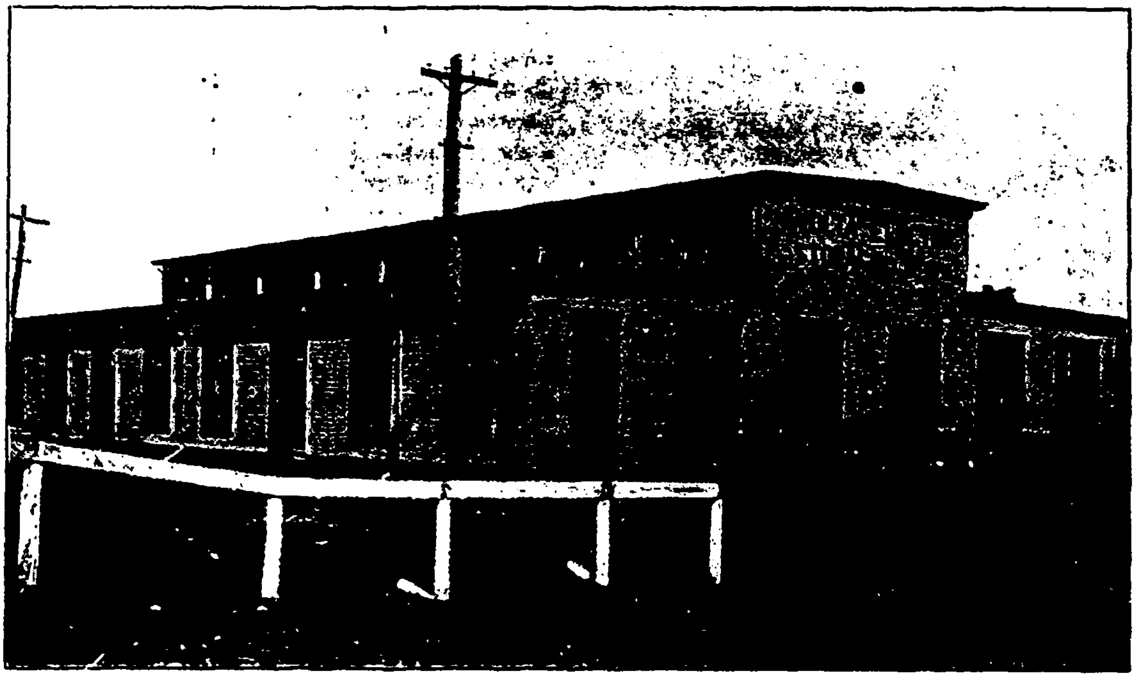
A unique blotter has been sent out bearing the compliments of Messrs. Sadler & Haworth, manufacturers of oak tanned leather belting, Toronto and Montreal. The blotters are held together by a celluloid button bearing an illustration of the Union Jack, while the name of the firm is inscribed on a fine sheet of celluloid covering the blotters.

THE VOLTA STORAGE BATTERY.

THE following description of the Volta storage battery is found in the prospectus of the Volta Electric Storage Company, of Hamilton, an illustration of whose works is presented herewith:

The problem of intercepting and retaining electrical energy is receiving its latest and fullest development in the adaptation of the original pile of Volta to the purpose of storage. Of course, the suggestion carries with it the necessity of upsetting and rearranging our ideas of storage battery construction. The excess of sulphuric acid electrolyte must go, but with it goes unnecessary weight, and one of the greatest inducements to sulphating that any cell arrangement can offer to the lead plates or grids. The containing sell must go, but with it goes also weight and space. The knowledge that a single plate may be an element must come, but with it comes the greatest possible compactness, and also an unlimited flexibility of application to all purposes for which electrical energy can be applied. The facility with which this metallic plate construction of Volta lends itself to the necessary variations required for the purpose of storage is remarkable. In fact, it largely consists in the constructing of the reservoir. The porous lead as applied is the analogue of the zinc, and the lead plate that of the copper, or the conducting side of the disk. It only remains, therefore, to increase the capacity of the porous lead so as to absorb more hydrogen, and to add the peroxide to the face of the opposite side of the sheet lead, to enable it to absorb more oxygen; and then to place between contiguous plates a moisture-absorbing material of sufficient capacity to furnish the electrolyte for producing the gases; and the thing is accomplished. Theoretically, therefore, we should expect to find more electrical energy per 100 lbs. of weight carried, and per cubic foot of space occupied, in such a reservoir than in one constructed on the plan of Plante and Faure, or in any other variation of the two volt Plante type.

An inspection of the accompanying illustrations will serve to certify us that the theoretical presumption is well borne out by facts. In the first place, there is no containing cell used in this high tension construction, whereas in the Plante there must be one containing cell for every two volt element. This containing cell, of course, must be greater than the mere superfices of the element; and we also know that this space must be filled with electrolyte. This combination increases both space and weight. Again, in each cell of the Plante type, there must be two lead terminals, carried well up above the surface of the acid, taking up still further space. In the high tension pile, on the other hand, these are eliminated; there being but two terminals even should the potential of the pile be carried to 100 or more volts. In the illustration shown the normal potential is 28 volts, while there are but two terminals one from the bottom plate, "the positive," and one from the top plate, "the negative." The path of the charging current is from the positive up, directly through the pile to the negative. This pile,



WORKS OF THE VOLTA ELECTRIC STORAGE CO., HAMILTON, ONT.

with an energy capacity of 100 ampere hours, and 28 volts normal potential, is contained in a space 11½ inches wide by 28 inches in length and 11 inches in height, equal to a little more than two cubic feet, for approximately four h. p. hours of energy, and with a weight of 240 lbs. total, or one h.p. for every 60 lbs. of weight carried. Where piles are built in larger units, both weight and space are reduced still further. Four such, piles occupying a space 28 inches wide by 44 inches long and 11 inches high will furnish current for twelve 16 candle-power 110 volt lamps for 15 hours. In other words, a space 28 inches wide and less than four feet long and 12 inches high will furnish sufficient room for holding a battery to light an ordinary building burning 12 lamps 5 nights of 3 hours each. The cost also, in proportion to ordinary storage plants, is very greatly reduced, such a plant costing the user $240.

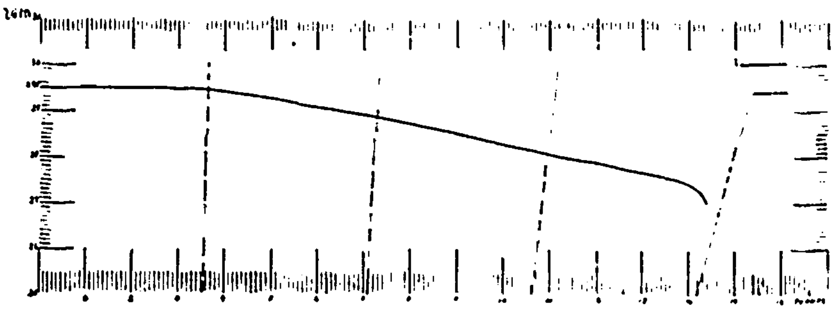


Fig. 2.

The accompanying plates show two curves, Fig. 2 representing the drop in potential of a single plate, or element, of this size during a discharge of 100 ampere hours, at a 7 ampere rate; the second, Fig. 3, representing a curve for the entire pile during the same discharge, showing a drop of 2 8/10 volts for the entire pile, or 2/10 per plate or element. This cut also shows the kinetic value of the pile in h. p. hours.

Among the noteworthy peculiarities of the high tension pile is, first, the fact that each plate is an element in itself, having a positive condition on one side of the plate and a negative condition on the other side, for the potential difference in a plate at full charge of 2 2/10 volts from the surface of the positive active material to the surface of the negative active material. When, therefore, in a well constructed pile the circuit is disconnected, that is, the outside circuit unclosed, it is an impossibility to discharge a single plate, because the points of potential difference are separated by the metal plate, a solid septum through which the necessary translation of ions is impossible. When, however, the outside circuit is closed, then the potential difference is along the line of that circuit from the positive terminal of the pile to its negative, and the electrical action and molecular interchange is between the opposite sides of adjacent plates. Antoher peculiarity of this battery is that the fumes, which are an unavoidable and never failing attendant upon the Plante type of battery, compelling its installation in separate and specially prepared apartments, and often at great expense, are entirely absent, so that it is practicable to set it up in a machine shop, or even a living room without injurious results to person or property. The value of this last feature cannot be overestimated, and taken in connection with its great compactness, its comparatively light weight and its small cost, it completes the list of desirable qualities which go to make up the perfect storage plant for the markets of the world.

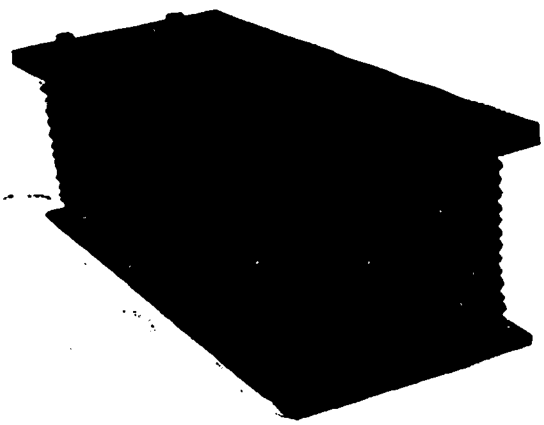


Fig. 1.—The Volta Storage Battery.

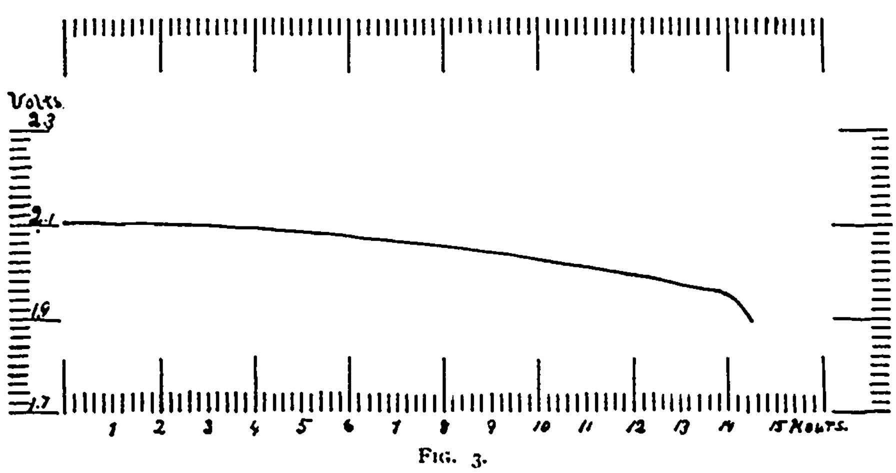


Fig. 3.

The Volta Electric Storage Co., Ltd., of Hamilton, Canada, are introducing these batteries for all such uses as indicated above, and for every other purpose for which electric current can be utilized. They are just now moving into their new building, from which they expect to supply the Dominion of Canada and also do a large export business.

Articles of incorporation have been filed for a company which purposes operating electric and steam railways in Cuba. This company has a capital of $8,000,000, and one of the chief promoters is Sir William Van Horne.

H. Walker & Sons, of Walkerville, Ont., have given a contract to the Michigan Electrical Co., of Detroit, for what is expected to be the most elaborate sign on the American continent. For the purposes of the sign, a separate iron structure on the river front, in rear of the offices of the firm, is being built. Between 4,000 and 5,000 four-candle power incandescent lights will be used. The letters will be clear, while colored lights will be shown in the border. It is estimated that 100 h.p. will be required to operate the lights.

An exhibition will be made in the Art Museum within a week or so of the result of work done by local students in the International Correspondence School of Scranton, Pa. This exhibition will be of special interest to local people, showing how far comparatively uneducated people may progress by improving spare moments in the study of lines of work in which they desire to perfect themselves. The Correspondence Schools interested in this exhibition have a remarkable following in this city, over 600 persons being enrolled as students here. The work covers almost every line in which working people are interested. An ambitious young man who has been forced to slight his common school education, turns to the courses offered by these schools, and, selecting the one in which he is most interested, begins the study. The plan of the courses pre-supposes only the ability to read and write. The first work is elementary, and the progress is gradual and possible only by becoming perfect in what has preceded. The student goes through the course, and at such a time as he completes the work receives a diploma, and the management of the schools is also interested in securing for the graduate better employment in keeping with his proficiency. The exhibition is made in the Art Museum at the suggestion of the City Library Association. In connection with the drawings, which will be largely of mechanical and architectural designs, the city library will have several shelves of books that are useful for reference in connection with the course given by the schools. It is hoped that those pursuing the studies may be interested in coming more frequently to the library. Springfield Republican, March 26, 1900.

COKE AS A STEAM FUEL.

The advantages of coke over coal as a fuel for generating steam were discussed at the Montreal meeting of the Cotton Manufacturers' Association by Arthur C. Freeman, of Waltham, Mass., who offered the following suggestions as useful in learning its management :

(1). In building the fire, put the coke on lightly and often, until the fire is 7 or 8 inches thick ; an 8-inch fire will make steam much better than a heavier one.

(2). It is better not to disturb the top of a coke fire, therefore when firing spread the fuel evenly, so as to keep the fire level.

(3). Shaking bars are very suitable for burning coke, and they should be shaken frequently. If dead bars are used, a light poker should be run under the fire frequently to keep clinkers from clinging to the grate, and to keep them broken up. A poker is better than a slice bar for this purpose, as it is lighter and more easily handled. The object is not to bar up the fire, but to detach small pieces of clinker and prevent them from forming and running together.

(4). It is advisable to keep water in the ash pit, or to introduce a jet of steam.

In support of his position, Mr. Freeman presented the result of a test made by the Mutual Boiler Insurance Company of Boston on the comparative evaporative powers of coals and coke compared with the best soft coals.

FRICTION ON STEAM PACKINGS.

Before the meeting of the American Society of Mechanical Engineers in December, 1899, Mr. C. H. Benjamin, of Cleveland, Ohio, read a paper on the above subject, describing some experiments made at the Case school with several varieties of packings. He gives four tables showing the results, which we reproduce, together with his comment and general conclusions.

Table I gives a summary of the results, showing the average horse-power consumed by each packing box at varying pressures, and, for purpose of comparison, the power at 50 pounds pressure of steam. The friction of the machine has been reducted.

Table II shows the effect of tightening the gland nuts on the friction of the packing, and also the effect of oiling the rod.

In most of the experiments detailed in Table I the nuts were tightened with the fingers only, and then just enough to prevent leakage, and no lubricant was used except that incorporated in the packing itself. With some of the dry rubber packings it was necessary to use oil from the first. A good quality of cylinder oil was applied.

The effect of varying the steam pressure is best shown graphically, as in Tables III and IV. The numbers at the ends of the lines correspond to numbers used in the the other tables. The ordinates indicate the steam pressures observed, while the abscissas represent the horse-power cosnumed by each box. The points where these lines cut the line of 50 pounds pressure are those used for comparison of the different packings. It will be seen that the friction varies with the pressure in approximately straight line ratios in many of the cases.

GENERAL CONCLUSIONS.

1. That the softer rubber and graphite packings, which are self-adjusting and self-lubricating, as in Nos. 2, 3, 7, 8, and 11, consume less power than the harder varieties. No. 17, the old braided flax style, gave very good results.

2. That oiling the rod will reduce the friction with any packing.

3. That there is almost no limit to the loss caused by the injudicious use of the monkey-wrench.

4. That the power loss varies almost directly with the steam pressure in the harder varieties, while it is approximately constant with the softer kinds.

The diameter of rod used—two inches—would be appropriate for engines of from 50 to 100 horse-power. The piston speed was about 140 feet per minute in the experiments, and the horse power varied from .036 to .400 at 50 pounds steam pressure, with a safe average for the softer class of packings of .07 horse-power.

At a piston speed of 600 feet per minute, the same friction would give a loss of from .154 to 1.71 with a working average of .30 horse-power, at a mean steam pressure of 50 pounds.

TABLE I.

Kind o Packing.	No. of Trials.	Total Time of Run in Minutes.	Average Horse-Power Consumed by Each Box.	Horse-Power Consumed at 50 Pounds Pressure	Remarks on Leakage, etc.
1	5	22	.091	.085	Moderate leakage.
2	8	40	.049	.048	Easily adjusted ; slight leakage.
3	5	25	.037	.036	Considerable leakage.
4	5	25	.159	.176	Leaked badly.
5	5	25	.095	.081	Oiling necessary ; leaked badly.
6	5	25	.308	.400	Moderate leakage.
7	5	25	.067	.067	Easily adjusted and no leakage
8	5	25	. 82	.082	Very satisfactory ; slight leakage.
9	3	15	.200	.182	Moderate leakage.
10	3	..	.275	....	*Excessive leakage.*
11	5	25	.157	.172	Moderate leakage.
12	5	25	.266	.330	" "
13	5	25	.162	230	No leakage ; oiling necessary.
14	5	75	.176	.276	Moderate leakage ; oiling necessary.
15	5	25	.233	.255	Difficult to adjust ; no leakage.
16	5	25	.292	.210	Oiling necessary ; no leakage.
17	5	25	.128	.084	No leakage.

TABLE II.

Kind of *Packing.*	Horse-power consumed by each box, when pressure *was applied to Gland Nuts by a 7-inch wrench.*						Horse power before *and after oiling rod.*	
	5 Pounds.	6 Pounds.	10 Pounds.	12 Pounds.	14 Pounds.	16 Pounds.	Dry.	Oiled.
1	.120	....	.136					
3	....	....	....	....	....	....	.055	.021
4	..	.248	....	.303	....	.390	.154	123
5	....	.220						
6	....	.348	.430	....		....	.373	194
7	.	.126	.228	.2[illegible]0	.330	.340	.067	.053
8	...	.361	.500	.535	.510	.533	.533	.236
9	..	.166	....	..	.		.666	.636
11	....	.405	.454	....	....	....	.454	.176
12	....	.161	.242	.359	.454		454	122
13	.	.317	.394	.582				
15	..	.526						
16	...	.317	.860					
17	.	.198	.277	.380				

TABLE III.
VARYING STEAM PRESSURE
SCALE 1 INCH = 0.1 H.P.

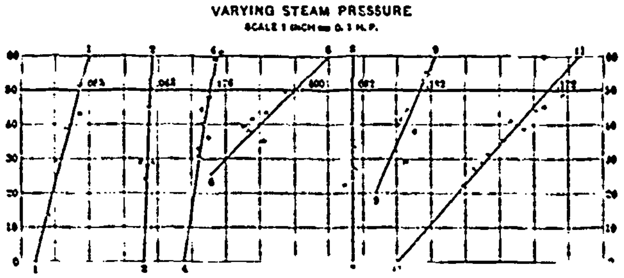
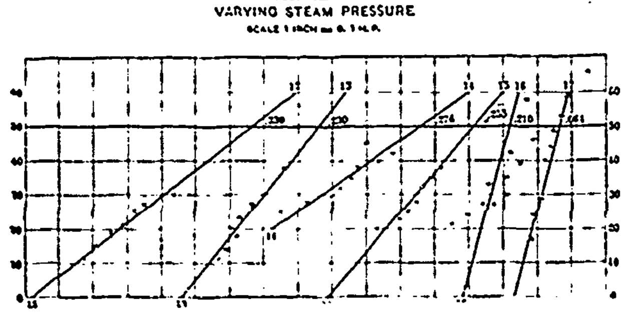


TABLE IV.
VARYING STEAM PRESSURE
SCALE 1 INCH = 0.1 H.P.



Mr. W. T. Steward, E.E., of Toronto, has furnished the town council of Woodstock, Ont., with a valuation of the electric light plant there, also an estimate of the cost of the installation of new and up-to-date machinery. The council contemplate municipal ownership and the remodelling of the plant.

THE DEVELOPMENT OF INTERIOR CONDUIT.

A FEW years ago saw the advent of iron electrical conduit; and while the welcome extended was not enthusiastic, yet the superiority of the tube over the asphaltic paper raceway was so manifest that electrical engineers soon came to demand such an installation in all high class systems. Since the old time tube, whose part was purely one of insulation, we have advanced to the tube the whole object of which is protection to the wire, insulation being placed where it is most serviceable, viz., on the wire itself.

The mechanically strong raceway for electrical conductors was a gradual but rapid growth, progress in this branch of the electrical field being forced by real necessity; it was found that protection to the wire from external mechanical injury was required, and along that line went development. The conduit first in use was composed of paper, which tube was later placed on the market encased in thin sheet brass. This was a step consistent with the purpose to which conduit was put. But brass proved ineffectual, and later a conduit was introduced which for a short time acknowledged no superior; this tube, called "Armorite," is yet being used in large quantities, a few engineers preferring a combination of insulating and protecting qualities in the raceway. In construction, "Armorite" conduit is peculiar, a description of which is as follows: The lining is made from live kiln dried basswood, cut with tongue and groove in two semi-cylindrical sections. These sections are then treated under pressure with a product of petroleum, which operation causes the liquid to penetrate the pores of the wood, thus destroying the active properties and excluding gases and moisture. The two sections of wood are then placed together (over a mandrel), forming a complete tube, and forced into a steel armor. The object in putting the wooden tube within the iron in two sections is that the conduit may easily bend to any angle without affecting the pipe or wood lining. During the early days of the manufacture of this conduit, the steel armor was a very light pipe; but the electrical trade required a stronger tube, consequently the light armored type was abandoned and a conduit manufactured embracing more rigidity and strength. This was accomplished by cutting the wood lining for a heavier gauge pipe and encasing same in a tube of the thickness and strength of the ordinary form of commercial gas pipe.

Finally, crowning the efforts in this line, was the introduction of "Loricated" conduit, a strong iron pipe, coated both on internal and external surfaces with a glass-like non-fused enamel. To this point has improvement in interior conduits advanced. And, judging by the satisfaction evidenced wherever this enameled tube has been installed, an improvement is not desired, if, indeed, improvement is possible. It is claimed that the highest class work and the most secure system of wiring is obtained by the use of enameled iron armored conduit, and that "Loricated" conduit is installed in all the monster buildings erected to-day, buildings on which are engineering marvels and which are as nearly perfect as the science of the times can devise. Limiting electrical energy to its proper channel is now a problem solved; the wire is carefully braided, the conductor then being drawn into a protecting raceway of enameled conduit, of the strength as above explained.

The protectory capacity of the conduit may for convenience in considering the subject be stated to be, firstly, in shielding the wire from mechanical injury, which might be caused by external agencies; secondly, in offering fireproof protection from the wire which may become heated; thirdly, in affording the installer with a smooth interior to the raceway into which the wires may readily be drawn without in any way tearing or otherwise injuring the braiding of the wire. In encasing the wire within an iron tube of the thickness and strength of commercial gas pipe, we have manifestly a sufficient protection to the wire from trowels, hatchets, nails and the like, to injury from which articles the unprotected wire would be subject at installation. The rigid pipe at no point on its surface offers an opening to a pointed tool, the smooth rounding surface turning the force of the blow from any instrument which might be directed towards the conduit. In this particular it is claimed to be in striking contrast with the flexible iron conduit, which at each unit of its length is said to present a crack or opening which will engage any point striking it, allowing danger to creep near the wire.

As to offering fireproof protection from any wire which may become heated, this point needs no enlargement; the fact is quite evident. It is apparent that most perfect results must necessarily be had in practice with the use of this superior type of enameled conduit.

One of the essential features of a perfectly safe electrical conduit is a smooth interior. This required smoothness, the manufacturers claim, is found most perfectly in a rigid enameled tube, as in tubes of other descriptions smooth and continuous surface is sometimes sacrificed in obtaining flexible, insulating and other unnecessary qualities. Slight observation will show to what extent a strip of steel or other metal wound in the form of a tube will cause an uneven interior surface; and to a slight extent the same fault is experienced in tubes which are lined with spirally wound paper, sheet rubber or other materials. A tube in the form of a gas pipe perfectly cleaned from burrs, scale and other imperfections (incident to pipe in the crude shape), the cleaned surface then being specially treated and prepared and finally enameled, as in the manufacture of "Loricated" electrical conduit, furnishes not only a safe installation for carrying electrical conductors, but also gives—what may not be of prime necessity, but is an item of importance in figuring cost—ease in construction and facility in drawing in the wire. In a tube of such description there is no buckling, no drawing away from the wall or straightening at the bends during installation, no splintering or loosening of a lining, no openings allowing entrance of moisture or particles of cement and like deteriorating agents to destroy the insullation of the wire, no projecting burrs or slivers of iron to tear the insullation, in short, no undesirable features; and after the wire is run safety is assured.

Messrs. Munderloh & Co., 61 St. Sulpice St., Montreal, Que., one of the leading electrical supply houses in Canada, advise us that electrical conduit has been a matter of serious consideration with them, and that they have found the trade call principally for the enameled type of conduit, the "Loricated" conduit, a product of the Safety-Armorite Conduit Company, Rankin Station, Penna., being generally used in high class installations. As a consequence, this is the only conduit they choose to handle. They have made such arrangements with the manufacturers that their stock is kept constantly replenished. They state that they hold the conduit trade of Canada (which is constantly growing to large proportions), and that they can lay electrical conduit down in any part of the country at most liberal terms.

ABOUT CONDENSERS.

IN arranging for jet condensation with engines of ordinary dimensions, it is necessary to use considerable caution, says the American Machinist, as by reason of the short time required to overflow there is danger of water backing up into the cylinder at stopping, or slowing down, and in such a case a breakdown is likely to occur on again starting ahead.

It is not always convenient to arrange the injection valve within such range of the throttle that it can be at once closed on slacking the speed, and even where it is so placed it is much more satisfactory to provide against flooding in a way that allows the valve to remain at normal opening, as the injection requires some attention to properly readjust after being once changed.

The best all-round method of accomplishing the desired result is to place a float in the condenser, an air cock being operated by the lever when water rises above a safety point. This arrangement relieves the engineer of all anxiety, his only responsibility being to see that the apparatus is maintained in proper repair and working condition.

If a float cannot be used, a simple air cock, worked from near the engine throttle, will be found the next best device, as by a turn of the hand wheel at slowing down air enters the condenser and holds the condensation water back without necessitating the closing of the injection valve.

The class of engine known as "high-pressure condensing," in which there is no vacuum under normal conditions—the exhaust steam being simply discharged into a tank of feed water for the purpose of heating the latter—should be supplied with a float and air cock, as on stopping the steam in cylinder on exhaust side of piston is liable to condense, and in that case, unless proper provision has been made to prevent it the feed water in tank will block up in the engine and possibly fracture the cylinder head when steam is again turned on.

The use of a float in either type of engine prevents flooding due to the pumps failing to function properly.

Air-pump valves are often found broken, if of metal, or torn, if of the soft rubber so often used, and in such cases the pump is likely to fail to clear the condenser.

Foreign substances, waste, chips, etc., are very often jammed in the passages, and where the valves open downward—hanging—held to their seats by springs, the stud nuts are liable to work loose, letting the valves fall into the chamber below. For this reason pumps should be designed with lifting valves only, in which type the springs can be much lighter, and the seating is far more satisfactory than where both the weight of valve and column of water must be balanced by the stiffness of a wire coil.

ENGINEERING and MECHANICS

EXAMINATION QUESTIONS.

W. H. WAKEMAN, in The Tradesman

(Continued from April issue.)

49. *How do you determine the capacity of a pump?*

A. Multiply the area of the piston by the stroke (both in inches) and by the number of strokes per minute. Multiply the area of piston-rod by the length of stroke, and by one-half the number of strokes per minute. Subtract this *from* the above, and the remainder will be the capacity of the pump in cubic inches, assuming it to be an ordinary steam pump. Divide by 231, and the result will be the number of United States gallons discharged by the pump, provided there is no "slip"; but the amount of water actually delivered will be less than the above calculation calls for, on account of the "slip," which varies with the kind of pump and its condition.

50. When piping up a pump, which valve would you put next to the boiler on the discharge pipe, and why?

A. The stop-valve should always be put nearest the boiler, in order that the engineer may shut off the pressure when necessary to examine or repair the check valve.

51. What is a British Thermal Unit?

A. The amount of heat necessary to raise the temperature of one pound of water one degree Fah.

52. The stroke of an engine is 48 inches and the cut-off takes place at eight inches. What is the ratio of expansion?

A. Six.

53. The initial pressure on a piston is 80 pounds, and the terminal pressure is 20 pounds, both absolute. What is the ratio of expansion?

A. Four.

54. The initial pressure on the piston of an engine is 95 pounds and the terminal pressure 7 pounds, both by the gauge. What is the ratio of expansion and how is it calculated?

A. This will depend upon the location, as the elevation above the sea will affect the result. In such cases it is customary to assume that the engine is at sea level, and to take the atmospheric pressure at 15 pounds per square inch, which must be added to both the pressures given, making them 110 and 22 respectively. Dividing the former by the latter shows that the ratio of expansion is five.

55. If the clearance is taken into account, how does it affect the result?

A.—It gives a lower rate, because the amount must be added to the stroke and also to the point of cut off. It is not taken into account when calculating the ratio by pressures.

56. Give five reasons for pounding in steam engines?

A. Lost motion in the bearings, loose and worn piston rings, lack of compression, insufficient depth of counterbore, and a piston that is loose on the rod.

57. What is lap on a valve?

A. The amount that it laps over its ports.

58. How many kinds of lap are there, and what are they?

A.—Two; inside and outside. The former means the amount towards the centre of valve, and the latter refers to the amount at the end of it.

59. What is meant by the lead of a valve?

A. The amount that it is open when the engine is on a centre.

60. What is a port on a steam engine?

A. A passage to admit steam to and exhaust it from a cylinder.

61. What are the larger on a Corliss engine, the steam or the exhaust ports?

A.—The exhaust ports are usually the larger, in order to allow the steam to escape without unnecessary back pressure.

62. Why are feed water heaters used?

A. In order to save heat by heating the feed water with exhaust, or waste steam, and to prevent unequal contraction of boiler plates due to feeding cold water.

63. If you were obliged to feed cold water into a boiler, how would you have the feed pipe arranged?

A. Such a practice should be condemned on every convenient occasion, but if it must be resorted to temporarily, the feed pipe should be continued into the body of water in the boiler, so as to avoid discharging it directly on to the plates.

64. *Give four reasons for the failure of pumps to work?*

A.—Failure of the water supply; leak in the suction pipe; valves that do not seat properly; and a piston that is worn so that the water slips by it.

65. Give two reasons for the failure of injectors to deliver water against pressure?

A.—If there is a leak in the suction pipe, air will enter and prevent the delivery of water, although it may not prevent the water from coming to the injector. If the water is so hot that it cannot condense the steam, the injector will not work against pressure.

66. Which is the heavier, a cubic foot of water at 40 degrees or a cubic foot of water at 210 degrees Fah.?

A.—The cubic foot of water at 40 degrees, because as heat is added raising the temperature above 40 degrees, the water expands and consequently becomes lighter.

67. A column of water is 60 feet high. How much pressure per square inch is on the base of it?

A.—The temperature will make some difference, but in all such examples it is customary to assume that it is about 60 degrees, in which case the pressure is found by multiplying the height by .434 and 60x.434 equals 26 pounds.

68. What is heat?

A.—Heat is a form of motion.

69. The fly wheel on an engine is 6 feet in diameter and revolves 210 times per minute. The main belt transmits power to a pulley on the jack shaft that is 4 feet in diameter. What is the speed of jack shaft.

A.—Three hundred and fifteen revolutions per minute. It is found by multiplying the speed of the fly wheel by its diameter and dividing by diameter of pulley on jack shaft.

70. The fly wheel on an engine is 18 feet in diameter and revolves 65 times per minute. What is the speed of the main belt?

A.—Three thousand six hundred and seventy-five feet. It is found by multiplying the diameter of wheel by 3.1416 and by the revolutions per minute. 18x3.1416x65 equals 3,675.

71. Does the cross head of an engine stop at each end of its stroke?

A.—Yes. It is impossible for the direction of motion to be changed so completely without first coming to a full stop.

72. How often would you blow down a boiler?

A.—That will depend on the quality of the feed water, the hours run per day and the rate of evaporation. In the case of a boiler worked to its full capacity, running from twelve to twenty-four hours per day and using a poor quality of water, it should be blown down once in four hours.

73. What is meant by the tensile strength of a boiler plate?

A.—It means the force required to tear asunder a bar of it that is one inch square.

WHEN A DYNAMO FAILS TO EXCITE.

In the case of a self-exciting dynamo which refuses to build up, a number of tests have to be made in order to locate the "trouble," and it is often necessary to make these in a hurry, for which reason it is advisable to make them in the right order. A list of these tests is given in a recent issue of the London Electrical Engineer, and they are briefly as follows: Make sure that the brushes are on the right place on the commutator, and, of course, see that the brushes really touch. Then see that they are set properly, relatively to one another; that is, if there are several sets of brushes see that the distances apart are equal; should the armature have a double winding, the brushes must, of course, cover more than one commutator strip at a time and must, therefore, be of the proper thickness to do so. Then start the machine and run it at its proper speed; if this does not make it excite, then find whether the shunt winding is really connected with the brushes, and if it is, then try for ground leakage, which is especially important in the case of a shunt machine, for if the field is short circuited the dynamo will, of course, not excite at all. Then see if there is not a break in the field winding, a fault which is more likely to arise in shunt machines. In looking for possible ground connections it is, of course, desirable to disconnect the machine from the circuits, as one of the two faults may be outside of the machine. *If all this does not help, try changing* the shunt connections at the brushes, for if they have been connected wrong it is evident that the machine cannot excite itself; also see to it that the field windings are so connected that they give the proper sequence of poles and *are not both north or both* south poles. If there are slight signs of a field it may help to connect the two halves of the shunt winding in parallel, if that is possible, as, for instance, if there are two coils to the magnet;

this would increase the current in the field; but this, of course, applies only to shunt and not to series wound machines, as in the latter the parallel connection would reduce the ampere turns. Also see to it that the shunt and series windings, if it is a compound machine, are not opposing each other, for in the latter case the machine might run with a few lights but would lose its field as the load is put on. If all this fails to locate the trouble, the armature must be examined; to find short circuited coils in the armature excite the machine separately from some other source and note which section becomes overheated. If this does not locate the trouble, then run the machine separately excited at the normal voltage and see if the armature has its normal output; if it has not and the machine is a new one, there is something wrong with the armature. If this also fails to locate the difficulty the case may be considered a fairly hopeless one, and an expert may be called in.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

ANNUAL BANQUET OF HAMILTON NO. 2.

The thirteenth annual banquet of Hamilton No. 2, C. A. S. E., was held at the Commercial Hotel, Hamilton, on Good Friday Eve, April 13th. Besides a large representation of local members, a number of visitors were present. The guests from Toronto included A. M. Wickens, Executive Secretary; Charles Moseley, ex-president Toronto No. 1; John Dixon, Toronto, No 18; John Bain, William Bourne, Joseph Hughes, and W. G. Blackgrove. The tables were tastefully decorated and an excellent menu was served. The chair was occupied by past president R. Mackie, while F. J. Sculthorpe acted as vice-chairman. The toasts were responded to as follows:

"Canada Our Home," Rev. J. H. Long; "Mayor and Corporation," Ald. Pettigrew, ex-Ald. Donald; "Manufacturers," Messrs. Lyman and Smith; "Educational Interests," J. S. Williams, C. R. Fessenden, W. Davidson, and R. W. Geddes, Boston, representative of the Scranton International School of Correspondence; "The Executive Head," Ald. Pettigrew, A. M. Wickens, Charles Moseley, John Dixon; "Sister Associations," John Dixon and a number of other visiting members from Toronto; "Our Host and Hostess," H. Maxey.

W. W. Barlow, Mr. Abbs, Dr. McLean and O. Penny contributed vocal selections, T. Arthur presiding at the piano.

The local committee who arranged for the banquet were: R. Mackie, chairman; T. Chubb, J. Ironside, W. R. Cornish, F. J. Sculthorpe, D. Hunter, T. Cook.

TRADE NOTES.

The Montreal Street Railway Company has placed an order with the Royal Electric Company for five 30 h. p. railway motors and controllers.

The Robb Engineering Co., Amherst, N.S., are building two 300 horse power tandem compound engines for the Demarara Electric Company, Georgetown, British Guiana.

The Waverly Gold Mines Co., of Waverly, N.S., has placed an order with the Royal Electric Co., of Montreal, for three of their direct current multipolar generators to light the Shubenacadie and Waverly mines.

The Robb Engineering Co., Amherst, N.S., recently received an order by cable from their English representatives, Messrs. Dick, Kerr & Co., for two 250 horse power engines for the Grimsby & Cleethorpes Electric Tramways.

Railway Motor Engineering is a new course of instruction offered by the International Correspondence Schools, Scranton, Pa. The course was prepared and is being kept up to date by Eugene C. Parham, superintendent of the Nassau Division of the Brooklin Rapid Transit. It is intended for operators and those who wish to become operators of electrical machinery, and contains practical instruction on the operation and maintenance of electric cars and motors. As instruction is carried on by mail, it affords a means of acquiring valuable information without obliging students to lose time from work.

The Canadian Association of Stationary Engineers, through Mr. Carscallen, M.P.P., brought forward at the recent session of the Ontario Legislature a bill providing for the inspection of boilers and the licensing of stationary engineers. A special committee was appointed to report on the bill. This committee, while approving to some extent of the principle of the bill, decided to take no action, but recommended that steps be taken next year to have a strict inspection of boilers in factories.

TELEGRAPH and TELEPHONE

CHEAPENING TELEPHONY.

The greatest difficulties to be overcome in the engineering of telephone systems are in connection with the intricate network of wires required. From the house of every new subscriber two wires have to be taken to the exchange, and every new wire considerably increases the risk of breakdowns and short circuits. English statistics show that the time of an averge conversation is only two and a half minutes, and that the average number of calls is only eight per day. Assuming, then, that the subscriber is at his instrument twenty minutes a day making calls, and twenty minutes a day answering them, it follows that his wires are only used for forty minutes out of the fifteen hours which is the general duration of the daily service. The average load on telephone wires is, therefore, only about 5 per cent. of their full carrying capacity. Hence if we could make one pair of wires serve for several subscribers we could greatly cheapen the cost of the service. In the Electrician Mr. West recently described a system of telephony he has elaborated, whereby one pair of wires can be made to several subscribers. It has been thoroughly tested by the German postal authorities, and Mr. West states that they intend introducing it shortly into the German public telephone service. In this system the subscribers in one group can only ring up the exchange one at a time, the mere act of taking the telephone off the hook cutting out the others. If there are five ordinary subscribers the wires will be in use during a quarter of the time the exchange is open, and hence there will be a good deal of waiting; but to make up for this they will have the benefit of a 50 or 60 per cent. reduction of rates. Even with only three subscribers in a group a reduction of 30 per cent. could be given. The West system seems to us an excellent method of cheapening the cost of the telephone to groups of subscribers (preferably in the same building) who only use it very occasionally, as well as doing something towards reducing the multiplication of wires.

SHORT-CIRCUITS.

The Bell Telephone Company are this year extending their underground system in Winnipeg.

The Bell Telephone Company are about to commence work on the building of a long distance system in Manitoba. We understand that 7,000 poles, which will cover 200 miles of the line, are now ready. It is understood that direct connection will also be made with the United States.

Several important improvements have been made in the Bell Telephone Exchange at Ottawa. The bell-ringing system has given place to automatic signalling telephones, the interesting feature of which is that instead of ringing the bell as formally, the subscriber has only to put the phone to his ear. The act of removing it from the hook flashes a signal lamp at central and a prompt response is made. When the phone is replaced on the hook, another signal is given which notifies the central that the conversation is ended.

Mr. S. S. Dickinson, superintendent of the Commercial Cable Company at Canso, N.S., left early in April for the island of Fayal, in the Azores, via New York. His mission was to arrange for the reception of the company's German cable which will land there. When completed the cable will make a direct connection between New York and Germany. Six hundred miles of this cable had just been completed off the cost of Nova Scotia, and the object was to commence paying out the cable from the Island of Fayal until a connection was made with the portion completed off the Nova Scotia shore.

SPARKS.

The council of Sarnia, Ont., has passed a resolution requesting the Sarnia Street Railway Co. to adopt electricity as a motive power.

The council of Burlington, Ont., is considering the advisability of putting in a municipal electric light plant or giving a franchise to a company.

The Sarnia Gas & Electric light Co. have placed a contract with the Goldie McColloch Co., of Galt, for a 200 h. p. engine for their lighting plant.

Mr. Ernest S. Harrison, electrical contractor, of Winnipeg, is installing a new dynamo for the Keewatin Lumber Co., and is also re-arranging their lightning system.

Several prominent business men are promoting a scheme to establish a large power plant to supply the street railway, water works and private and public lighting in Woodstock, Ont.

The town council of St. Mary s, Ont., has been discussing the question of taking over the electric lighting plant of Mr. L. H. Reesor, and of submitting a by-law to the ratepayers for the purpose.

The village council of Canington, Ont., decided at a recent meeting to engage an electrical engineer to value the electric light plant, which will probably be taken over by the corporation.

Surveys have been made to locate an electric railway from Greenwood into the gold mines of the Deadwood, Wellington and Summit camps, the power to be supplied from Cascade. The promoters are the Greenwood and Pheonix Tramway Co., and the cost is estimated at $100,000.

The dam across the Murray river, built by the Labrador Electric and Pulp Company, is about completed. By the end of June it is expected that the villages of Murray Bay and Pointe au Pic, Quebec, will be lighted by electricity.

The Railway Committee of the Ontario Legislature has thrown out the bill of the Port Stanley Electric Railway Co., by which power was sought to increase the capital of the company from $40,000 to $240,000 and to build a line to London.

The Hinton Electric Company have submitted to the city council of Victoria, B.C., a proposition to operate the city pumping station by electricity. The cost was gi en as $22,900, made up as follows: Engine and dynamo, $9,800; 100,000 gallon electrically driven pump, $7,600; necessary wire, line material, etc., $5,500.

MOONLIGHT SCHEDULE FOR MAY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1	P.M. 7.30	A.M. 4.00	83.0
2	" 7.30	" 4.00	83.0
3	" 10.30	" 4.00	53.0
4	" 11.00	" 4.00	50.0
5	" 11.30	" 3.50	42.0
7	A.M. 0.10	" 3.50	34.0
8	" 0.30	" 3.50	32.0
9	" 1.00	" 3.50	25.0
10	" 1.20	" 3.50	23.0
11	" 1.50	" 3.50	20.0
12	No Light.	No Light.	.....
13	No Light.	No Light.	.....
14	No Light.	No Light.	.....
15	No Light.	No Light.	....
16	P.M. 7.40	P.M. 10.20	2.40
17	" 7.40	" 11.10	3.30
18	" 7.40	A.M. 0.00	4.20
19	" 7.40	" 0.30	4.50
20	" 7.50	" 1.10	5.20
21	" 7.50	" 1.40	5.50
22	" 7.50	" 2.10	6.20
23	" 7.50	" 2.50	7.00
24	" 7.50	" 3.30	7.40
25	" 7.50	" 3.30	7.40
26	" 7.50	" 3.30	7.40
27	" 8.00	" 3.30	7.30
28	" 8.00	" 3.30	7.30
29	" 8.00	" 3.30	7.30
30	" 8.00	" 3.30	7.30
31	" 9.00	" 3.30	7.30
		Total	145.30

THE FORTHCOMING CONVENTION.

THE fire which occurred in Ottawa recently will not, we understand, seriously affect the forthcoming convention of the Canadian Electrical Association, although it will increase the labors of the members of the local committee. This committee is working faithfully to make the convention an unprecedented success. The committee on papers has also been performing its duties energetically, and some excellent papers have been secured. Among them is one by Professor Owens, of McGill University, on "Utilizing the Available Central Station Capacity"; another by Mr. F. H. Leonard, of Montreal, on "Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps," and another by Mr. O. Higman, of Ottawa, on "Government Electric Standards." Papers are also expected bearing upon telephony and telegraphy, the operation of street railways, and other interesting subjects. The date of the convention is June 27th, 28th and 29th.

THE OTTAWA FIRE.

THE electrical companies in Ottawa suffered heavy loss by the recent fire which commenced in Hull, and which destroyed the major portion of the city of Hull and nearly two thousand buildings in Ottawa. The fire totally destroyed the street railway power house and contents, but the new 1200 k. w. generator direct connected to six Stillwell-Bierce horizontal turbines, which was installed recently in a new power house, was saved owing to its being built largely underground. The Ottawa Electric Co. (the lighting company) being the result of the amalgamation of three former electric lighting companies, had six power houses, namely, one central distributing station and five sub-stations, one of which was a steam station, and another was devoted to arc light exclusively. Four of these sub-stations, including the arc light station, were totally destroyed, even the walls of the buildings being useless. The company was left with its central station and steam auxiliary. While the arc light station was burning negotiations were going on for machinery for temporary use. We understand that letters of sympathy were received from the principal electric lighting companies in Canada, and valuable services were rendered by the Royal Electric Light Co., of Montreal, and the Toronto Electric Light Co. The company is now engaged in setting up, in a building owned by Mr. J. R. Booth where some water wheels were available, a temporary sub-station which will enable it to carry on its ordinary service while a new plant is being installed. The company is now supplying nearly all its incandescent service and motor service. Three days after the fire 150 street lamps were going, and it is expected that by the 10th inst. all the street lights will be on.

The Street Railway Company did not stop running, although the service was limited to some extent for a few days. They are now running full blast.

It is the intention of the Ottawa Electric Co. to erect a new and strictly up to date plant.

REMOVAL NOTICE.

After May 1st the Montreal office of this publication was removed to larger quarters in the Imperial Building, 107 St. James street. Customers will always find the office open during business hours, and visitors in Montreal are extended a cordial invitation to call at the office, where they will be given every possible assistance and furnished with requisites for answering correspondence. The telephone number is Main 2299.

PERSONAL.

Mr. Melitz has been engaged as electrician by the corporation of Acton, Ont.

Mr. John E. Wilson has commenced his duties as inspector of gas and electric light at St. John, N.B.

The management of the Winnipeg Street Railway have appointed Mr. Albert Mitchell as superintendent of the system, in succession to Mr. H. J. Somerset, who has removed to Australia.

Mr. W. Y. Hayes, manager of Bell Telephone Company at Windsor, Ont., is receiving the congratulations of his friends upon his recent marriage. The bride was Miss Harris, of London.

Mr. C. H. Wright, son of Mr. A. A. Wright, of Renfrew, has joined the engineering staff of the Canadian General Electric Company. Mr. Wright has been employed for the last four years on the Montreal Belt Line Railway, and when leaving he was dined by his fellow employees and presented with a diamond scarf pin.

The Sydney Gas & Electric Co., Sydney, C.B., is installing a 150 k.w. "S.K.C." two-phase generator, purchased from the Royal Electric Co., of Montreal.

Mr. John Carew, Lindsay, Ont., has ordered from the Royal Electric Company a complete electric light plant to light his saw mill and lumber yards. The order included a 10 k.w. multipolar generator.

PUBLICATIONS.

"Compound Engines" is the title of a booklet of fifty pages just issued by the Power Publishing Company, of New York. It consists of a series of lectures by R. F. Lowe, re-printed from the columns of Power.

The Fort Wayne Electric Corporation have issued a booklet showing the prices paid for electric lighting throughout the United States. The arrangement is tabular form, the population, number of lamps, candle power, schedule, price per lamp, and cost of fuel, whether steam or water power, being given.

The Gas Engine Publishing Company, of Cincinnati, Ohio, have sent us a copy of the Gas Engine Hand-Book, by E. W. Roberts, editor of The Gas Engine. From a perusal of the book we can safely say that it is a valuable work, containing no descriptive matter relating to any particular engines unless the engine is a type in itself, as is the case with the Diesel motor. The author has covered in the 220 pages almost the entire subject of the gas engine design, and many of the formulas given are claimed to have not previously appeared in any work. Fifty thousand copies of the first edition were issued.

SPARKS.

The fire and water committee of the Berlin city council has been empowered to advertise for tenders for street lighting.

Local capitalists at Selkirk, Man., have applied for a charter to construct an electric railway and telegraph line from Winnipeg to that place.

The Baltimore Railway and Coal Company is considering the question of developing the oil wells in the vicinity of Baltimore, Albert County, N. B.

The electric light plant at Cardinal, Ont., was almost completely destroyed by fire on April 18th. The fire broke out in the Edwardsburg starch works.

The Montreal Star have placed an order with the Royal Electric Company for three 30 h. p. motor Teaser equipments, to be direct connected to their new printing presses.

The town of Yarmouth, N.S., has just taken tenders on two compound condensing steam engines of 60 h.p., with two boilers and fittings, for operating the plant at the pumping station.

It is said that the business of the Still Motor Company in Toronto has been purchased by British capitalists.

The Royal Electric Company, of Montreal, is installing an electric light plant for the Moulthrop Lumber Company in their mills at Spanish River, Ontario.

The Nova Scotia Electric Light Co. has made a second survey of the source from which it is intended to derive electric power for the Annapolis Valley. The company is said to be making plans to commence work at once.

The Marine Telephone Company, Limited, of Letete, N.B., is seeking incorporation, to establish a telephone system between St. George, Letete, Fairhaven, and other places. J. F. Catherine and Judson Matthews, of Letete, are interested.

Mr. W. B. Chapman, who is interested in the Demarara Electric Co., Georgetown, British Guiana, has returned to Montreal after an absence of five months. Mr. Chapman states that the work upon the electric plant is progressing favorably.

At the last meeting of the council of St. Louis du Mile End, a suburb of Montreal, the Royal Electric Company was given the contract for street lighting for the next five years. Forty-two lamps will be used, and the price, we understand, is $115 per lamp.

The forty-first meeting of the American Society of Mechanical Engineers will be held in Cincinnati, Ohio, commencing on May 15th. Papers will be read on the following subjects: On the Value of a Horse Power; Hot Water Heating from a Central Station; Systems of Efficiency of Electrical Transmission in Factories and Mills; Multiple Cylinder Engines; The Automobile Waggon for Heavy Duty.

Last month the Ontario Power Co. signed a contract of agreement with the commissioners of the Queen Victoria Niagara Falls Park, and paid over the some of $300,000 representing the rental for two years. The company received its franchise to develop power from the Niagara river. The Ontario Power Co. will compete with the power company at Niagara Falls, N.Y. It is said to be the intention to commence development work immediately, the inital development to be from 30,000 to 60,000 h. p. The prospect of transmitting it to Toronto and Hamilton is reported to have been considered. The estimated cost of the proposed work is $2,000,000.

SPARKS.

The Ottawa Railway Co. intend building new car sheds.

The Calgary Water Power Co., of Calgary, N.W.T., has just installed a new two-phase generator.

The county council of Colchester, N. S., will purchase a new boiler for heating the registry office and jail at Truro.

The electric plant at St. Hyacinthe, Que., was inundated by water last month, and for a time the town was in darkness.

The electric light plant at Digby, N. S., is still owned by Major Daley, who purposes thoroughly overhauling the system.

A committee of the council of Bedford, Que., is obtaining information as to the cost of electric lighting, and it is probable that a civic plant will be installed there.

The Keewatin Power Co. are understood to have closed a deal with the owners of the Sultana mine to transmit power from Norman to the mines, to operate the machinery.

Incorporation has been granted to the Plessisville Electric Co., of Plessisville, Que., to supply light, heat and power throughout the counties of Megantic and Arthabaska. Mr. Francis Hurtubise is manager of the company.

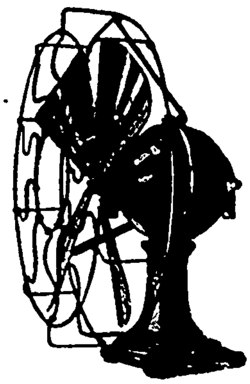
The council of Merritton, Ontario, recently employed the services of Mr. W. T. Steward, E.E., of Toronto, to value the electric light plant of that place, as the corporation purposes purchasing the same in the near future.

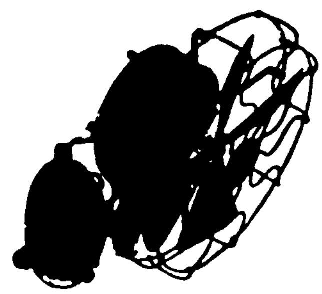
Incorporation has been granted to the Suderland Electric Power Co., of Suderland, Ont., with a capital of $10,000. The provisional directors are: James McDermott, *J. B. Valentine*, *Hendry* Baldwin, James Doble and T. H. Glendining.

Canadian General Electric Company's

FAN MOTORS

1900





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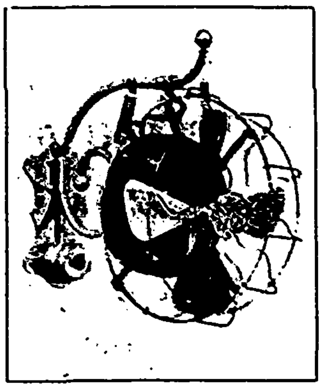

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