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For THE CANADIAN ENGINEER.

RAILWAY ENGINEERING.*

BY CECIL B. SMITH, MA. E., MEM. CAN. SOC. C.E., ASSISTANT PROF. OF CIVIL ENGINEERING IN M GILL UNIVERSITY.

CHAP. V.

ROADBED CONSTRUCTION.

ARTICLE 18. LARGER WATERWAYS WITH HEAVY EMBANKMENTS.

When a single box culvert 4 by 5 feet in cross section or, with very long covers and corbels, possibly 5 by 5 feet, will not carry the maximum flow of a stream, we must either use double or treble box culverts or an arch culvert. The intermediate walls of double box culverts may be made pointed to divide the flow of water, and a screen or paling may be erected some distance up stream to catch driftwood, but, even at best, their use is doubtful for the same reasons as for double lines of culvert pipes, *i.e*, the danger of logs, etc., choking up the entrance, whether an arch culvert of equivalent area will be cheaper than such a structure will depend on the availability of brick, cement or cheaply cut stone for arch sheeting on the one hand, or of large-sized stones for covers on the other.

*This series of papers will be issued in book form as soon as they have appeared in THE CANADIAN ENGINEER.

ARTICLE 19.—ARCH CULVERTS.

The selection of materials for the construction of arch culverts will depend on circumstances; where good weathering stone can be easily quarried and cut in the vicinity it will be usually used, but if stone is scarce or costly, and well-burnt brick plentiful, then brick may be found cheaper; of course brick so soft as to be unable to stand erosion or frost should never be used on exterior faces or for the arch sheeting. The use of concrete for arch culverts is yet a very occasional one in America, but is likely to steadily increase as we have more skilled civil

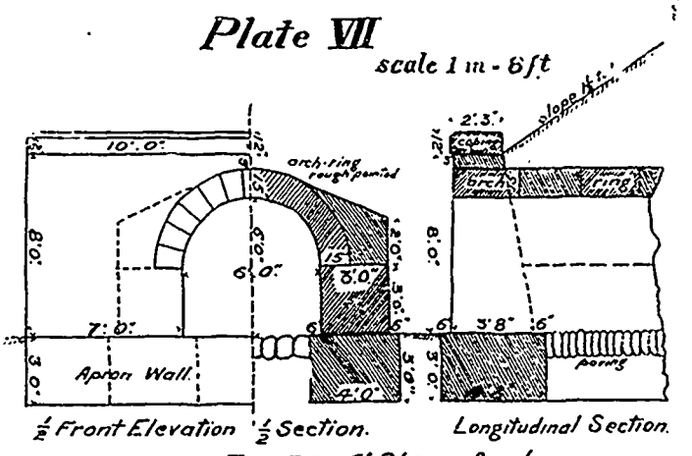


Fig. 33. 6' Stone Arch.

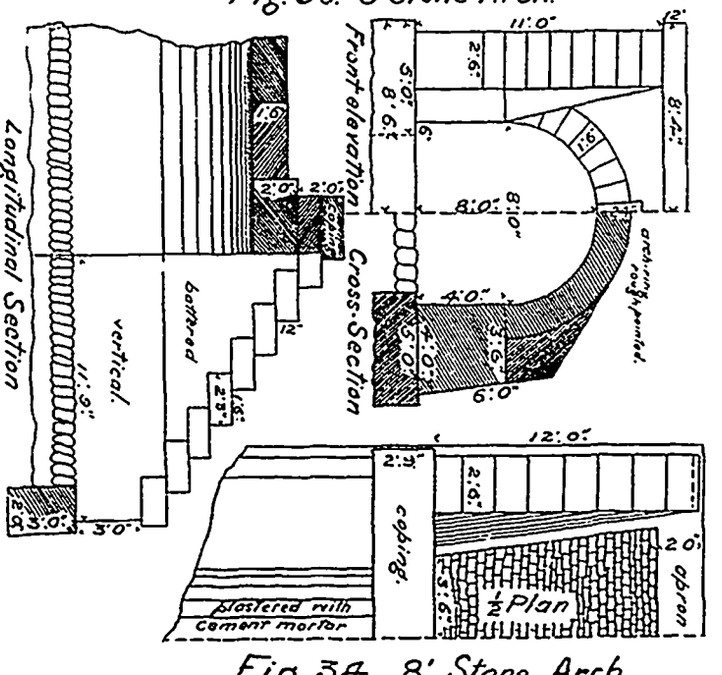


Fig. 34. 8' Stone Arch.

engineers who are familiar with the production of a cheap concrete with superior exterior finish, capable of standing frost and erosion and certain to remain sound for an indefinite number of years, which necessitates using absolutely sound, high-grade cements, and until an engineer has the opportunity of making certain of his cement by systematic testing, he is advised to avoid the use of any but the very smallest monolithic arch culverts, although, of course,

their construction presents no structural difficulties, beyond the precaution of defining occasional lines of separation in the arch sheeting so as to avoid irregular contraction lines.

Plate VIII

Scale 1 in. = 12 ft.

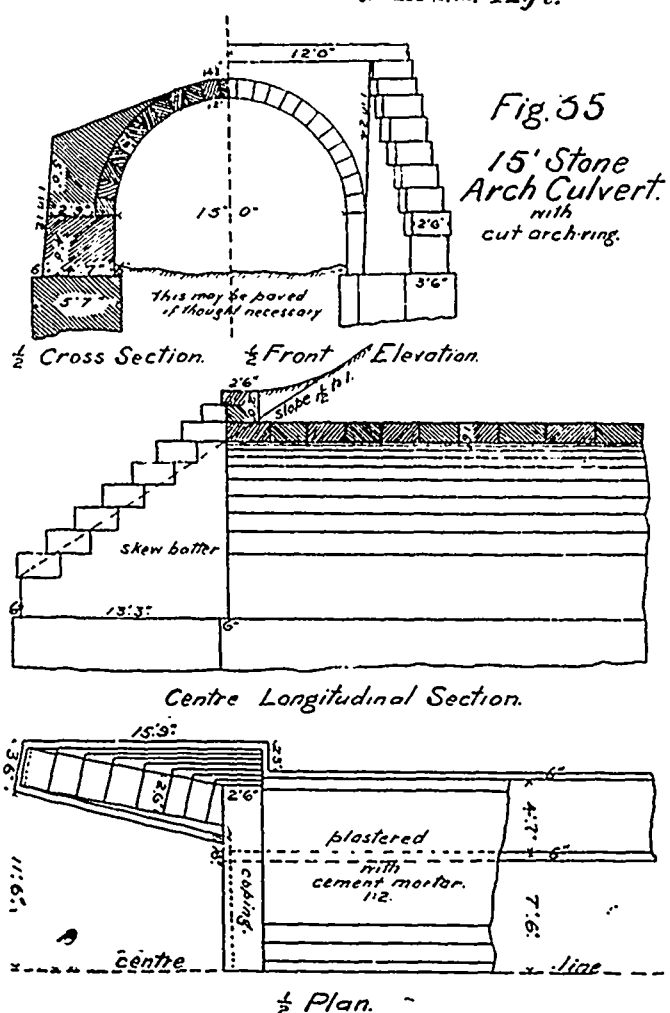


Fig. 35 15' Stone Arch Culvert with cut arch ring.

The chief features of arch culvert designing are:—

(*a*) The shape of the end walls.

(*b*) The depth, class and form of the arch sheeting.

(*c*) The dimensions of the arch abutments.

(*a*) The shape of the end walls will depend on the span of the arch and its rise.

For small semi-circular arch culverts, say from 5 to 8 feet span, the retaining head-wall shown, Plate X., Fig. 39, and Plate VII., Fig. 33, is generally used; for segmental arches of somewhat longer span the same may be advantageous, but as soon as a larger retaining wall becomes necessary its use should be abandoned in favor of stepped wings; the reason for this is that a surcharged retaining wall, with nothing but mortar to bond it to the back of the ring stones and often loaded with wet, slippery clay filling, is liable to be displaced, unless made very heavy, and thus the designs, as shown, Plate VII., Fig. 34, and Plate VIII., Fig. 35, of the types shown on Plate X., are found more suitable. The choice between straight wings and flaring ones, or between wings flush with the faces of the barrel of the arch, and those set back clear of the ring stones will depend much on the taste of the designer; for small spans liable to catch driftwood the choice should rest on flush wings, with some flare to avoid contraction, but with larger spans, of say 15 feet or over, a wing set back so as to show the arch ring stones will have a better appearance, and give equally good or better bond between the wing and the abutment or parapet wall. The small parapet wall of a culvert with stepped wings is well buttressed and very stable; the wings themselves usually have a face batter of 1 in 12 to 1 in 24, and a section at any point suitable for a level retaining wall (*i. e.*) about $\frac{1}{16}$ height + batter, their length will be economically curtailed at a point where the steps are 2 feet or 3 feet above the ground level. Stepped wings are preferable to those with inclined copings, as the latter are liable to become dislodged in time, and do not give an easy means of climbing the bank, and, also, the coping of a parapet wall of a brick arch culvert should preferably be a stone one, as bricks are liable to be displaced by ties, boulders, etc., rolling down the bank.

(*b*) The form of the arch will depend on the depth of bank; wherever headroom permits, a semi-circular arch is used, partly because the arch sheeting stones are less expensive than those for any other than segmental arches, being all cut from one template, and partly because the abutments need not be so heavy; but as the quantity of cut arch sheeting is greatest in a semi-circular arch the saving is not very great on the structure as a whole, but when the depth of bank is the limiting feature, a much greater waterway can be obtained by the use of arches of small rise to span, elliptical, segmental, or basket-handled, at a slight increase in cost. In small arches, it is cheaper to use roughly cut or even rubble arch sheeting of a greater depth, than to build one of first-class cut stone of less depth; but as the span increases, the economy of carefully cut and bedded arch sheeting will point to the use of the minimum depth. The workmanship on stone arch sheeting should be of the quality figured on, and if cut stone is called for, it should be as shown in the upper diagram of Fig. 40, because if left narrow at the back, the mortar that fills up the discrepancy being weaker and more compressible than the stone tends to throw excessive loads on the inner faces of the stones; this is a point over which too great an amount of inspection can hardly be given, especially if the stones are of minimum depth. When deep rubble arch sheeting is used, the mortar will be strong enough to stand the pressures allowed.

Plate IX

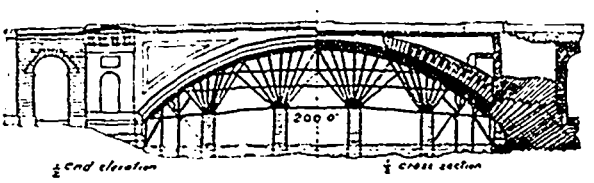


Fig. 36 Segmental Arch

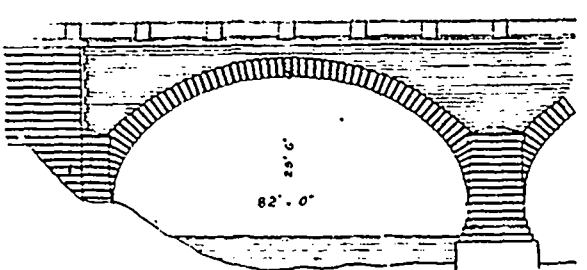


Fig 37 Semi-Elliptical Arch.

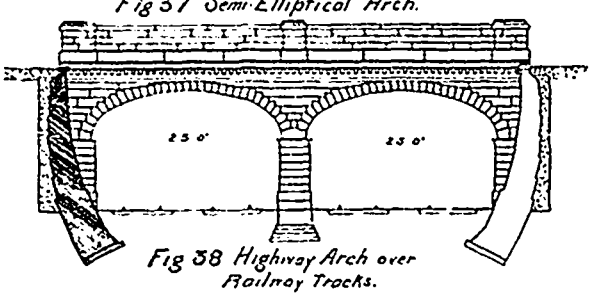


Fig 38 Highway Arch over Railway Tracks.

If arch sheeting is of brick a greater depth must be allowed usually than for stone, unless the brick is of very good quality and well bonded, and as bricks are not usually made bevelled unless for a very large contract, and are all of a uniform size, the bonding of the several rings of brick in arch sheeting of several bricks in depth is not possible except at arbitrary intervals, depending on

Plate X

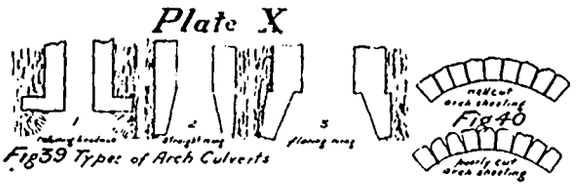


Fig39 Types of Arch Culverts

Fig40

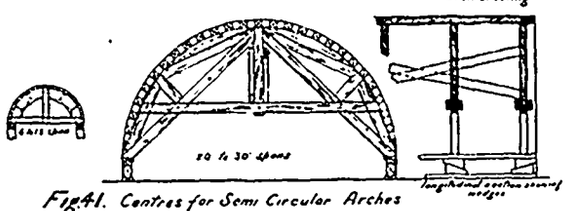


Fig41. Centres for Semi Circular Arches

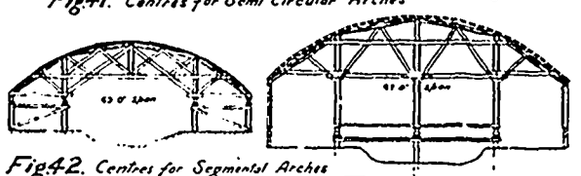


Fig42. Centres for Segmental Arches

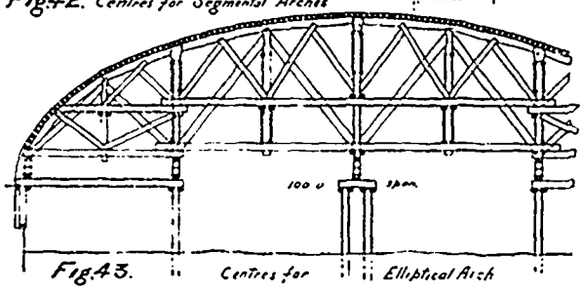


Fig43. Centres for Elliptical Arch

the curvature, when the outer ring is one brick thickness behind the ring inside it, at which point a header is inserted; for a circular arch this is about once every 33° of arc and is independent of the span. Longitudinally both brick and stone arch sheeting should be well bonded also, and after the arch has been completed and the centres removed, a heavy coat of cement mortar (1 to 1) should be plastered over the back of the arch down over the haunches or spandrel filling so as to prevent percolation through the joints. In construction of the arch and spandrel masonry the two sides should be carried up at about equal rates, as a heavier load on one side will tend to push over the timber centres.

(c) Arch abutments need not be made of such an expensive class of masonry as that of the arch sheeting. A rock-faced ashlar about equal to second class bridge masonry is suitable, and in designing their dimensions due regard must be had to the character of the filling behind the abutments and the depth of filling over the crown.

There cannot be said to be any fixed law by which the dimensions can be determined. The various theories advanced disagree in vital points. Some take account of the horizontal thrusts tending to increase the stability of the abutments, and some do not; some attempt to allow for rolling loads, and others use only a uniform quiescent load. It may be said in general, that for small arches where there is a large margin of safety allowed, and under heavy banks where rolling loads have little effect, the dimensions as given by Trautwine are satisfactory, but where it is deemed necessary to construct a curve of pressures, Scheffler's theory of least crown thrust and neglecting horizontal forces errs on the side of safety and is easy of application; and in constructing curves of pressure taking the point of rupture as the critical point it will be noticed that these curves pass rapidly toward the back of the arch sheeting into the haunch filling before they reach the springing line, when a uniform depth of sheeting is used equal to the depth necessary at the keystone, or slightly greater; this makes it evident that there is no such thing as a semi-circular arch, but that a segment of about 120° (60° on each side of the vertical) is a true arch and the remainder is really a part of the abutment, and for this reason the spandrel (haunch filling) masonry should be carefully constructed near the springing line and of as good a class of masonry as the face walls; higher up, however, it may be of rubble masonry as its weight is its only function.

The foundations of arch abutments are a very important consideration, as a very slight settlement will derange the curve of the arch and endanger its stability. If the foundation bed is not found to be uniformly good after careful testing with an iron bar, the best way to distribute the pressure is to lay a foundation course of concrete, or

Plate XI

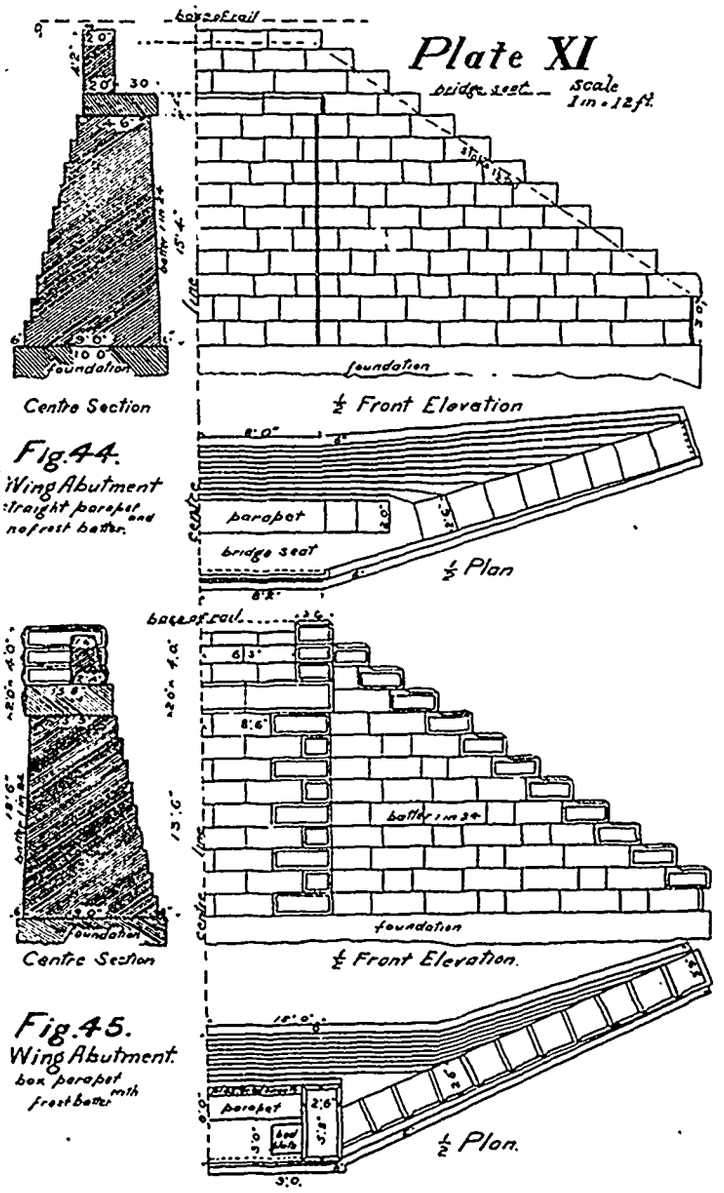


Fig.44. Wing Abutment straight parapet and no frost batter.

Fig.45. Wing Abutment box parapet with frost batter

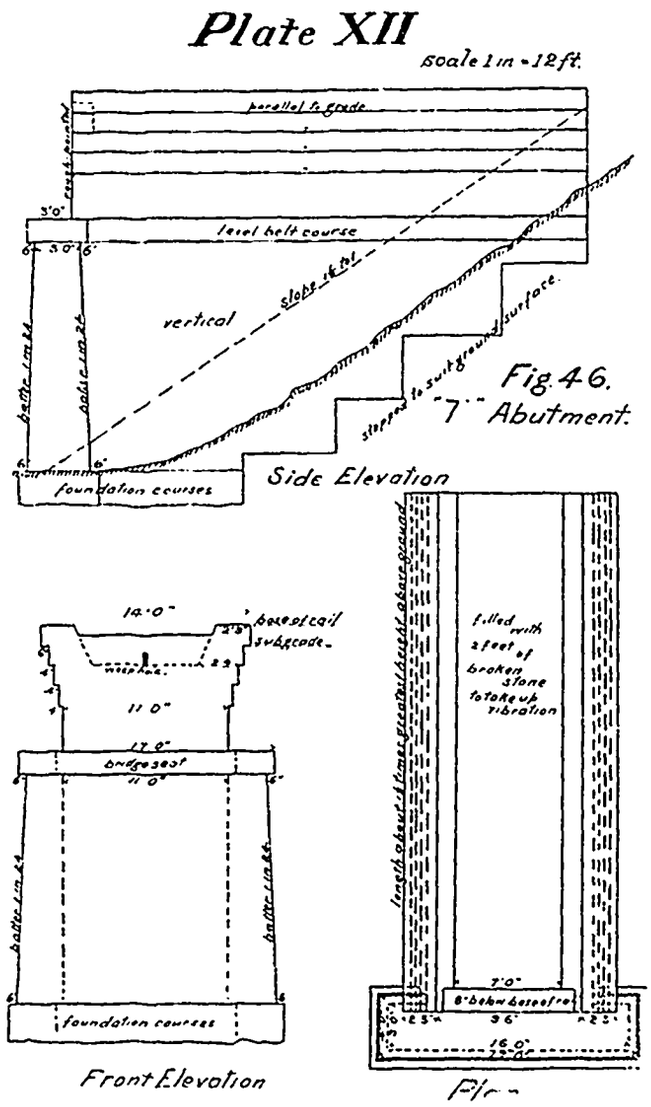
piles and concrete, if the bearing power of the soil is not found sufficient.

ARCH CENTRES.

To support the arch sheeting during construction and give the correct form to the arch a series of timber seg-

ments with an exterior covering of longitudinal strips or timbers is used, until the keystones are inserted. They should be designed for the weights they are to carry and rigidly supported so that absolutely no settlement may occur. But at the same time each point of support should be either on wedges that can be slackened, or on cylinders filled with sand that can be drawn off gradually at the proper time. Soon after the keystones have been inserted the easing process should begin and should be in two stages. First, a slight easement sufficient to bring each joint under pressure, and in a week or two later when the mortar has become hard they may be gradually and uniformly lowered so as to throw all the load on the arch. Figures 41, 42, 43 and 36 illustrate types of centres, and the wedges are shown in Fig. 41.

Specification for Stone Arch Culvert Masonry.—It will be laid in cement mortar of approved quality, the



arch sheeting stones shall be of the length, depth and thickness shown on the plans, or such as the engineer shall prescribe, and shall be cut accurately on their intrados, beds and joints according to template, and shall be carefully laid with a thoroughly good bond lengthwise of the arch. The face ring stones shall be left rough on the face, except a 1½ inch intrados draft, and no projection allowed of more than 3 inches from such draft. The spandrel filling shall be rough rubble similar to good box culvert masonry, but of good bed, bond and quality of stone. The abutments and wings, or head walls and parapet walls shall be either first-class or second-class bridge masonry as the engineer may direct. (See bridge masonry specifications.

The cost of arch culvert masonry will vary with the price of stone cutting, price of brick and labor, but may be taken ordinarily at $6 per cubic yard for rubble arches; $8 to $10 for second-class arch abutments; $10 to $14 for cut arch sheeting; $8 per cubic yard for ordinary brick arches.

The quantity of masonry in arches of even the same span and rise will be so entirely dependent on the height of abutments and depth of foundations that no table will be given. The tables given for purposes of approximate estimates in Trautwine "Engineer's Pocket Book," will be found very useful.

Article 20.—Arches.

So much has been written on this subject and the design of large arches for rivers or roadways, or for carrying roads over railways, etc., has received such elaborate study, that it is outside the range of this work, but types of such structures are given on Plate XI., and many of the remarks on arch culverts will apply to the larger structures with even greater emphasis, (*e.g.*), the importance of immovable foundations, and taking care of the line of pressures below the haunch and in the abutments, for this purpose the abutments are often built with the beds inclined to the horizontal and nearly at right angles to the pressure, see Fig. 36, and in any case should never be further from such a right angle than the angle of friction of stone on mortar.

Whether in a given case an arch or two abutments and a plate girder span will be preferable, depends on the depth of the bank and width of stream, as far as economy is concerned, but other considerations are the greater durability and safety of an arch, its finer appearance and an absence of repairs.

The use of concrete with steel rods or wire embedded in the tension side of the arch sheeting has lately come into use for arches of small rise, especially where rolling loads tend to distort the arch, the possibility of this form of construction lies in the fact that steel and concrete have almost identical co-efficients of expansion.

Article 21.—Bridge Substructures.

As the size of waterway increases, the cost of an arch soon becomes excessive, owing to the heavy abutments necessary for arches of long span and small height. On the other hand the cost of bridge abutments increases very rapidly with the depth of bank, so that we have two limiting features to guide us in the selection of the style of structure most suitable for a given small stream or creek, *e.g.*, with a 30-foot span and embankment 30 feet high the costs about equal each other. But whenever the arch does not cost appreciably more than the open span it should be selected, owing to the absence of floor repairs and to increased safety given. It must be remembered that the addition of a solid buckleplate floor and ballast to a plate girder will, however, make it practically safe and almost eliminate repairs.

When the stream to be crossed is of considerable magnitude the question of span lengths will be the first one to decide upon, which must be done with due regard to the probable life of iron work and the cost of replacing and painting it, as well as to the total present minimum cost of structure.

The approximate minimum cost of structure is obtained when the cost of the trusses, not including the floor system, is equal to the cost of the masonry, which should include the cost of foundations, etc., but exclude the cost of those portions of abutments of which the function is to retain the earthwork and not to support the bridge, *i.e.*, the wings, etc; but it is usually safe to arrange the spans so that the

masonry will cost slightly less than the iron, because the estimate of the latter can be made quite accurately, whereas the actual expenditure incident to river masonry construction will usually be in excess of preliminary estimates unless made with great judgment, especially in deep rivers of uncertain bottoms.

ARTICLE 22.—BRIDGE ABUTMENTS.

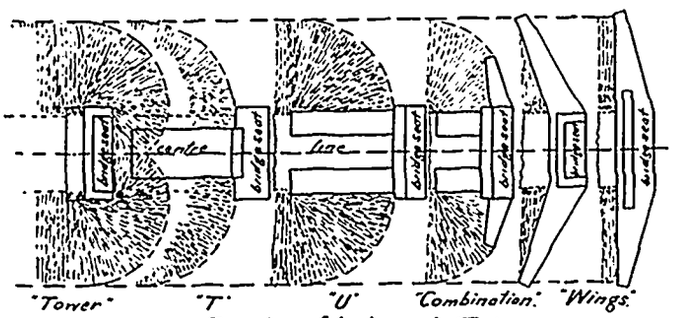
The most suitable design for an abutment will depend on the ground configuration, the position of the face of the abutment relatively to running water liable to scour, and to the amount of earth filling available—the various types in use are shown in Fig. 47. Of these, the tower abutment is always the cheapest, but can be used only when the embankment may be made all around it, on dry ground; the filling at the sides and front should be carefully made so as not to endanger its stability, practically it is used in two cases: First—Often as an abutment to an iron viaduct, with an adjacent heavy cutting and no stream to interfere with the foot of the slopes; and second, when a ravine is partly filled by a necessarily heavy cutting; but no borrow is convenient to complete the remainder, and an iron span must be used to bridge an insignificant stream.

The "T" abutment consists practically of a pier to carry the bridge span, and a masonry approach to carry the track onto the bridge. The objections to the "T" abutment are, that the masonry is damaged by vibration from the trains, and that the front cannot well be protected from river scour. The first objection is met by designing the stem of the "T" to be filled with two feet of rock ballast, to take up vibration; but the abutment must be kept well back from the bank of a stream liable to scour. The cost of a "T" abutment is less than any other (except the tower), when the conditions are favorable. These conditions are, that it is to carry a deck truss, and that the stem of the abutment is stepped into an ascending hillside, thereby lessening the quantity of masonry in it considerably. See Plate XII, Fig. 46. Essential advantages of this abutment are that it is practically in stable equilibrium from earth thrusts as the earth slopes run around the stem, and that water cannot lodge behind it. For through trusses needing wide piers, a "T" abutment is not especially economical, unless the saving on the hillside steps is considerable. The masonry for the pier should be first or second-class bridge masonry, but the interior of the stem may be of heavy rubble, with a cut facing, thus reducing the cost of the abutment to an average price of $8 to $10 per cubic yard.

The "U" abutment is similar to a "T," except that the stem is split into two parts and separated until considerable filling can be placed between the two parts. For deck spans up to 25 feet in height and through spans up to about 30 feet in height, the masonry in this abutment is less than in a "T" abutment, but above this height the quantities increase very rapidly owing to the increased lateral dimensions of the wings, which are designed as level retaining walls. The class of masonry necessary, however, is superior in the wings to that of the masonry in the stem of the "T" abutment, and the average cost of masonry will range from $1 to $2 per cubic yard more, or, say, $9 to $12 per cubic yard, so that it is very seldom less expensive to build than the "T" abutment, but it is very much used, owing to an impression that the wings are not affected by the train vibration. It must be kept well back from a scouring stream, and the toe of the slope in both of these classes of abutments should be protected by rip-rap, if there is any running water. Another serious objection to a "U" abutment is that it is liable to lodge water between the wings. This should always be provided for by weep holes. Whether this abutment is cheaper than a wing abutment will depend on the allowable slope of the earth, and also on the economy that can be effected by stepping the wings into the hillside, see Fig. 48. Some engineers economize masonry in the stems of "T" and wings of "U" abutments by introducing semi-circular arches of 10 ft. to 20 ft. span, just back of the pier-portion of the abutments

The wing abutment is usually used where the ground is level behind the abutment, and where the face is close to running water liable to scour, in which case the wings are flared back about 30° so as to prevent any contraction of the waterway. This abutment presents a neat appearance, and the backing may be made of rubble masonry, thus reducing the cost of the whole to about the price of "T"

Plate XIII



Bridge Abutment Types. Fig. 47

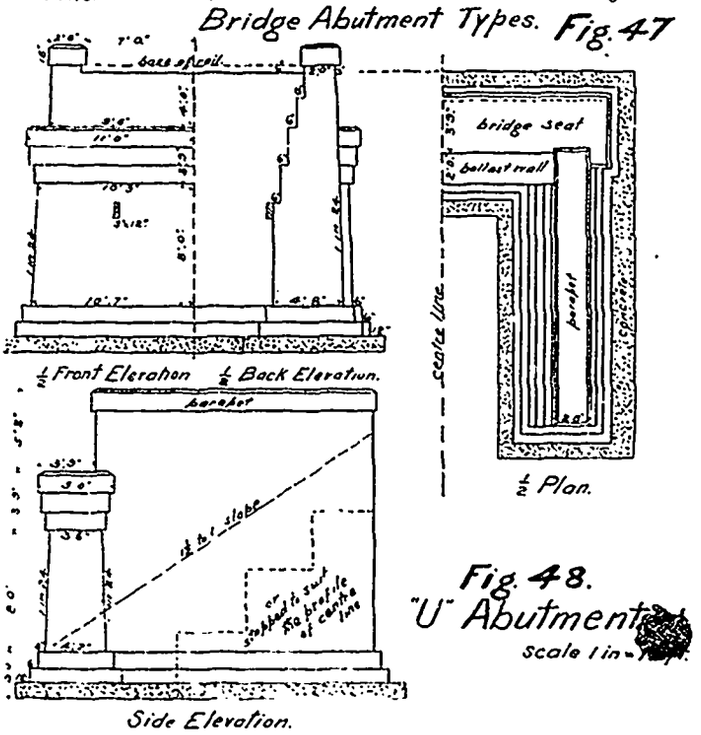


Fig. 48. "U" Abutment.

Scale 1 in.

abutment masonry, *i.e.*, $8 to $10 per cubic yard, but it has several objectionable features: if the foundation below footings is deep, to good bottom, the quantity of masonry in the foundation is excessive. See table XV. (C). And also, its design as a level retaining wall is always a question of more or less doubt. The ordinary rule of the width at base, being $\frac{4}{10}$ of the height + the front batter, is satisfactory if the filling behind is of average quality, but if made of heavy wet slippery clay, the structure may be in danger. Again, in designing the foundation it is necessary to know that it will always receive support in front or else the rule of $\frac{4}{10}$ must be carried down to the foundation bed. For these reasons, an abutment with a straight back and only a tapering to the wings is preferable to one with

wings flared back, as it does not hold water behind it so readily and is not under so severe a strain tending to crack the wings from the body of the abutment. To increase the stability of a wing abutment the foundation pit in front should be always rammed solid with clay, or preferably concrete, up to the ground level, and in cold climates a frost batter given to the back of the parapet wall. See Fig. 45. This prevents the frost from dislodging it.

There is a great diversity of opinion regarding the correct cross-section of retaining walls in general, and in applying any rule or formula the utmost caution is necessary, because each design is a problem in itself; items to be considered are: the material to be used for backing, the manner of placing it, the slope of the natural ground behind and in front of the abutment, the drainage of the area behind the abutment, the kind of masonry and mortar to be used, etc. So many complexities would thus be given to any theoretical formula that in such designs it is, in most cases, best to be guided by past successes and failures in structures that have been similarly situated. The actual design of an abutment is very simple, the depth from base of rail to bridge seat, and the length of truss will be given, and also the distance apart of the trusses, centre to centre. Thus, deck trusses will need a bridge seat about 16 feet long and 3½ to 4½ feet wide, while through spans require bridge seats 22 to 25 feet long and 4 to 5 feet deep. The approximate quantities of masonry for different styles of abutments as given in table XV. and plotted in diagrams, will be understood as extending to a uniform foundation level, the quantity saved in "T" and "U" abutments by stepping into the hillside must be deducted, and the quantity in foundation courses added, both of which will be so much less favorable for wing abutments in any comparison involving deep foundations or steep hillsides.

TABLE XV.

APPROXIMATE QUANTITIES OF MASONRY IN ABUTMENTS.

(A.)

FOR DECK PLATE GIRDER SPANS, BRIDGE SEATS 16 FEET WIDE, CALCULATED FROM DESIGNS GIVEN IN FIGS. 44, 46, 48

Not including footing courses.

Style of abutment.	Depth from base of rail to top of footings. 10' c. yds.	15' c. yds.	20' c. yds.	25' c. yds.	30' c. yds.	35' c. yds.	40' c. yds.
Straight wing abutment	38	80	151	257	402	596	841
"T" abutment, earth slopes, 1½ to 1	45	120	227	366	538	742	979
"T" " " " 1 to 1	27	77	150	244	361	500	661
"U" " " " 1½ to 1	43	101	210	338	582	858	1,195
"U" " " " 1 to 1	31	71	144	243	391	575	800
Tower " thickness 50 per cent. of height	27	49	79	119	166	222	285

(B.)

FOR THROUGH SPANS, BRIDGE SEATS 22 FEET WIDE, CALCULATED FROM BAKER'S "MASONRY CONSTRUCTION."

Not including footing courses

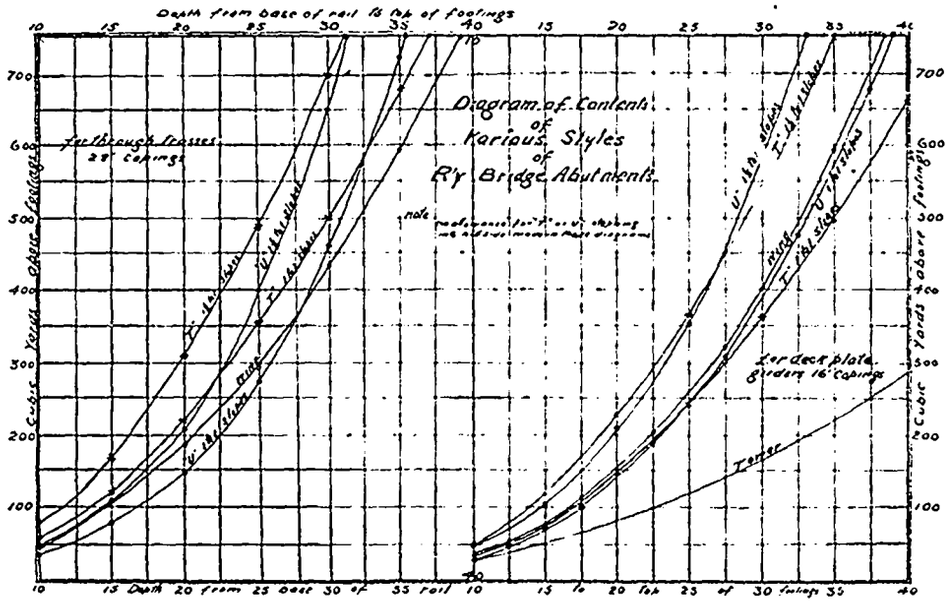
Style of abutment.	Depth from base of rail to top of footings. 10 c. yds.	15' c. yds.	20 c. yds.	25 c. yds.	30 c. yds.	35 c yds	40' c yds.
Wing abutment	41	104	186	293	426	588	781
"T" abutment, earth slopes, 1½ to 1	78	169	309	481	696	...	...
"T" " " 1 to 1	56	120	219	346	491	676	879
"U" " " 1½ to 1	47	107	206	386	650	...	...
"U" " " 1 to 1	30	80	149	271	452	712	1,025

(C.)

AREA OF FIRST FOOTING COURSE FOR FOUNDATIONS OF ABUTMENTS AS ABOVE IN SECTION (A), ALLOWING 6" PROJECTION ALL AROUND.

Style of abutment.	Depth from base of rail to top of footings. 10 sq. ft.	15 sq. ft.	20' sq ft.	25 sq. ft.	30' sq. ft.	35' sq. ft.	40' sq ft.
Straight Wing Abutment	205	384	569	797	1,047	1,330	1,673
"T" abutment slopes 1½ to 1	202	299	400	499	599	700	801
"T" " " 1 to 1	142	209	280	349	419	489	559
"U" " " 1½ to 1	193	311	477	670	917	1,076	1,250
"U" " " 1 to 1	129	213	323	458	614	724	806
Tower "	114	149	196	243	290	337	384

—Pressure on our columns has obliged us to hold over a number of interesting articles till next issue. Among them is a description of the new silver-lead mines in the Ottawa valley, and the further discussion of the Toronto city hall question.



DISPOSAL OF TOWN'S REFUSE.

BY W. M. WATSON.

(*Continued from last issue.*)

A report just come to hand from London, Eng., on the work of one city commissioner, states that at Lett's wharf, where the dust and refuses are carted, the following articles of value were found among the garbage during the twelve months ending September 1st last, viz., cheques for £40, £23 13s., £31 16s., £42 14s. and £3; a dividend warrant for £27; a demand note for £1,000; a promissory note for £706, which were returned to the owners and reasonable rewards received, together with a good deal of money, gold rings, watches and other valuables. From the small section of London tha use Lett's wharf they received besides the above, for old paper, £541 17s.; old rags, £47 10s.; bottles, £84 16s.; string, £181 3s. and books, £24. The old metals are not given in the report, so that there is more to be got out of the public refuse than many suppose.

Furnaces very similar to what is described in part can be seen working at Deseronto, Ont., only the fire boxes are not so large, because they are regularly fed by a long chute direct from the saws and carried along by a

carrier chain that feeds each boiler, keeping the fire box always full up to the top. Shoreditch, in England, compares well with many towns in Canada, inasmuch that a large quantity of the refuse that they destroy is shavings and sawdust from their staple industry of cabinet-making; that throws a large quantity of heat which is taken advantage of by that small town to supply themselves with electric light, and it is stated to be a genuine success. To add to this, they have the income from the sale of metals and other things of value sorted out of the garbage. We are told that seven towns that have visited Shoreditch by deputation are intending copying their method.

The increase during the past few years in the units of heat extracted from coal, and the fact that it is possible to convert refuse into fuel, is largely due to the improved arrangements in building flues, the design of furnaces, and adding a combustion chamber to mix and re-burn the gases and smoke that are cast off by the fires. This not only largely increases the units of heat, but also the temperature is increased, due to the introduction of combined air and steam blowers, which give a strong blast, as well as moisture, to the fire, so that the combustion of the fuel used is increased and the waste products lessened, and clinkers are prevented from adhering to the fire bars. The leading blower of this class was invented by a Canadian named Earl. It is composed of a bunch of fine steam jets that blow downward through a large taper pipe acting as an injector, bending at floor line, and passing horizontally through the brick wall into the ash pit, which has air-tight doors; behind the steam jets a pipe made from sheet iron is conveyed to above the crown of the boiler, so that when the steam jets are set in motion they draw a swift current of warm air down, which mixes with the steam, enters the ash pit, and passes up through the fire bars, coming in contact with the body of fire at the under side. The success of the refuse destructor patented by the Horsfall syndicate is due to a combined steam and air blower, similar to Earl's. Another of the kind, patented about the same period by Meldrums, has only one steam jet fixed near the end of a taper 3-inch pipe through which a strong current of air is drawn in when the steam jet is working. The combined apparatus is so small and compact that it can be easily attached to a Lancashire boiler.

I take it to be more economical to assist combustion and to increase the temperature of a furnace by blowers acting directly on the fire than it is to draw up the fire by using a long chimney, because when draughts are created by chimneys the force is at the terminating end of the heating surface, similar to a locomotive, which has its blower in the mouth of the smoke stack. By using a chimney to increase the temperature of the furnace, the hot gases are partly drawn away from the surface of the heating plates and tubes, the object of the passing heat being to get to the chimney shaft as quickly as convenient, where in most cases the hot gases arrive before they have sufficiently exhausted their heat on the heating surface of the boiler. Proof of this is established whenever a chimney is burnt out, which is often the case at the root, plainly pointing out that thousands of dollars' worth of fuel has been wasted.

While in England last year, I was shown a boiler furnace built a few yards away from where the boiler was set up on the Siemens system—the system by which steam is raised from towns' refuses, compelling the fiery gases to travel and increase their temperature before they reach the place of work. This one had proved a failure and a fuel eater, but not from any fault of the system, but from the ignorance of the designer and bricksetter. The space between the fire-box and the front of the boiler, which should have been a combustion chamber to mix and reburn the gases, was simply a large straight open space, too much for the fire to make and keep red hot, so that the gases leaving the fire made a bee line through the culvert or large flue, decreasing, in place of increasing, the temperature of the gases. The furnace should have been in two divisions, so that when one received the green coal the other would be white hot, and the gases both entering one flue, the gas coming from one with the highest temperature would take up the gases and smoke from the green coal of the other furnace and burn it, so that they both would gain the high temperature required. To enable them to do this the flue should have been somewhat smaller, so that the brickwork would be permanently as hot, if not even hotter than the fire, and have a series of fret work or bridges that would split up the gases dividing them so as to be prepared to be taken hold of by the white heated brickwork of the combustion chamber and super-heat the gases, giving them probably about double the units of heating power that they had when they left the fire bridge.

I have dwelt on this heating question because my experience in Canada is that some public works are spoiled in the minor details, or badly and ignorantly managed, which wastes a pile of public funds. For example, what a large amount of fuel and labor is wasted in the Toronto cremators that are a bill of expense and of small use, because the fumes of the foul garbage is often sent up the chimney to contaminate the atmosphere that ought to have been purified by being re-burnt in a combustion chamber when the incinerators are newly charged. To get a good practical lesson on the capabilities of refuse destructors the inquirer should visit Hamburg, Edinburgh, Shoreditch, and Bradford, where the handling of towns' refuses is performed on business principles, with the object of improving the health of the inhabitants and easing their expenses.

In this country we have many miles of land covered with sawdust and other saw-mill refuse, tannery refuse and similar combustible material that is rotting and throwing off injurious gases, creating an unhealthy atmosphere, that could be turned to profit and made to supply the nearest town or village with light and heat, or to turn the machinery for some manufactories. It is said that tannery refuse contains many units of heat, and by using a light steam and air blower it can be burnt easily, yet I saw a few weeks since three steam boilers fired with bought fuel within a few yards of a small mountain of spent tan bark that is an eyesore and a nuisance in the neighborhood. Besides all this, owners actually go to considerable expense in erecting plants to cremate the refuse from their saw-mills, which looks like wilful waste at the present time when heat and power can be transmitted many miles to places where there is a demand for it. It would almost appear that many of our people overlook these facts like the late John Stuart Mill, who made the remarkable speech in the British Parliament with the object of warning the nation against the reckless use of their coal, pointing out that the supply was limited, and that Britain's greatness partly depended on her coal. It had never crossed his mind that the sea and other waters could be made to give fuel and heat, and that the repulsive dirt and garbage swept up and collected in towns can be made to act as coal fuel, and give out as many units of heat per pound as coal was made to give in England forty years ago, and they are yet a long way behind us in England, because they blacken the air with the smoke from their boiler fires which ought to be used to assist in heating.

There is another waste in cities and towns; where coal is used, we notice the commissioners' carts tip ashes that contain a large quantity of good fuel. Take a load of ashes, sift it with a quarter-inch riddle, place the residue in water for about a quarter of an hour, sift it again, and sort out the clinkers and other unburnable material; then you will find that there is about half the load, clean washed carbon, that will burn as easily and give nearly as many units of heat as small pea coal. It is too bad to throw such carbon away, when many persons need more heat, and we depend upon the United States for our supply of coal.

Persons should never expect a brick setter, except he has been specially trained, to be able to build flues that will stand the heat, or turn the corners and the bends properly in a way that the heat will strike and hug the right places where it is most needed. I had a large boiler set in brick by what I thought, and was assured, was a trustworthy boiler setter; but the apparatus would not heat, and on examination it proved that he had turned the bends of the flues in a way that the heat struck the bricks and not the boiler plates, and when the error was corrected the boiler heated thoroughly. Last year I spent a half hour looking through the mica window that showed the interior of the general combustion and heat collection chamber, surrounded in a circle with about 20 refusefurnaces, at Hammerton street, Bradford, England. Each furnace had a separate combustion chamber for the reburning of its own fumes and gases, from each of the twenty combustion chambers the gases passed into the large collecting and combustion chamber, which appeared to be about 20 yards long, 5 yards wide, and 3 yards high. The outlet of each flue leading from the small combustion chamber of each furnace entered the large one near the crown, and the gases of each could be plainly seen as they entered. There was more variety in the color of the gases than there is in the rainbow. The exact state of each fire could be known by the color of the gas the furnace was discharging. If it was a dark red it showed that the furnace was newly charged and the gases from it, even after passing the white hot brickwork of its own combustion chamber, were of too low temperature, and that the fumes coming off the burning night soil and ashes were not properly consumed, and that if such low temperature gases were allowed to pass up the chimney, they would poison the atmosphere.

Only one furnace was charged at a time, so that the other 19 were in a state of white heat, or approaching that point, so that when the low temperature gases from the new-fired furnace entered the general collecting chamber the higher temperature gases from the other 19 furnaces mixed with it, picked it up, re-burnt it, or we might say superheated it, thoroughly destroying the poisonous fumes it contained when entering the chamber before it could enter the long carrying flues to be used to raise steam by passing under and through the heating tubes of the boilers. In this second general collecting and combustion chamber lies the secret of the general success of the refuse destructor and the purity of the gases discharged from the destructor chimneys.

I have now given examples and detailed explanations to prove that the very best and most useful inventions can be made worthless and expensive by ignorance displayed in construction and management— that those towns which really desire to improve the health of the inhabitants and reduce taxation, by adopting methods invented by gifted, thinking men, may easily do so by securing the best and most experienced managers obtainable in the labor market, and do public business on the same lines as well managed private firms do theirs.

When the Hon. Joseph Chamberlain became the head of the municipal affairs of the great city of Birmingham, England, he quickly brought the public business from a state of chaos to reasonable efficiency. Such a head in Toronto might be worth at the present time about forty thousand dollars a year to the public. When Mr. Chamberlain was lately presented with the freedom of that well governed city of Glasgow, he stated in his speech that when corporations undertake such business as is now conducted by the great municipalities of England and Scotland, that their officials, the men who are entrusted with the management of departments, must be men of special capacity, special ability, or else there will be indifferent administration and great waste of public money. Canada would be quickly a great nation if it could import a dozen such men to act as controllers, and prevent public funds being spent on worthless appliances and excursion trips of men who pretend to take notes of machinery and works that they do not technically understand themselves, and often could not possibly give a valid reason for the statements made in their reports.

(To be continued).

THE LIFE OF GOLD MINES.

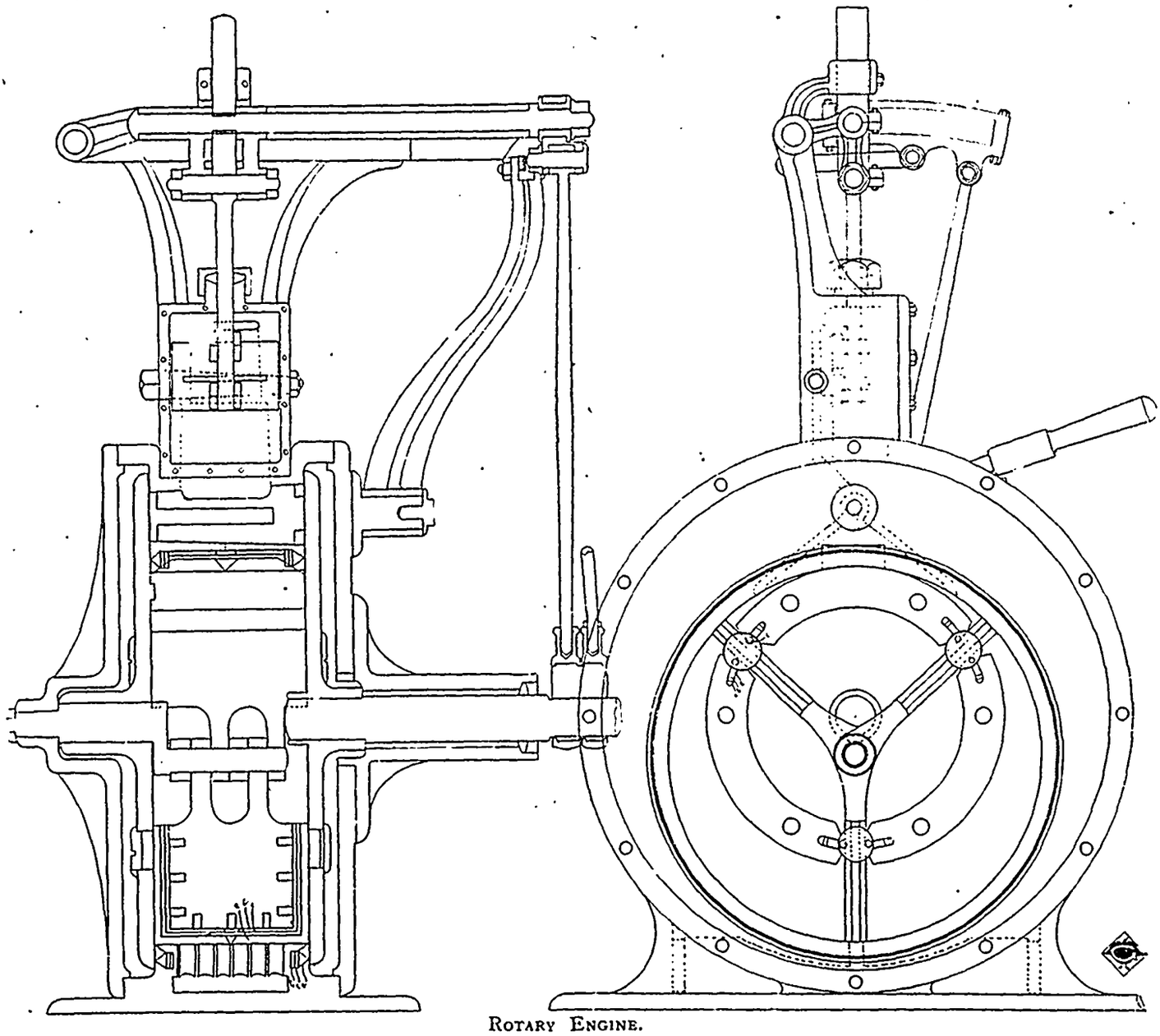
Now that many people are beginning to look on gold mining as one of the chief industries of Canada, more interest is taken in all details of mining processes than formerly. One of the most interesting parts of the subject is that touching upon the probable life of mines, because this is a factor of the greatest consequence to the operator of the mine, as it affects his profits directly, and is also a factor in the permanent development of the country. If we are to have a rush of miners to the Klondyke, attracted by the placer diggings, we shall reap only a temporary advantage; but if a great industry can be built up there in regular quartz mining, as Wm. Ogilvie the explorer of the country believes, and to that can be added coal and copper mining as well, the permanent character of such workings becomes of paramount interest. Extending at short intervals from Nova Scotia in the southeast to the Yukon in the far Northwest, Canada has a stretch of gold-bearing lands which are approached by those of no other country in the world. If these mines prove to be even ordinarily rich, the amount they will contribute to the wealth of the country is incalculable.

The gold mines of the Rand in South Africa are, perhaps, the scene of the most scientific mining which is being done in the world to-day, and the results of investigations made by the Rand mines are valuable aids to an estimate of possible conditions in Canadian mining, though of course the cases are, at best, remotely parallel.

The economic value of the main reef (Witwatersrand) was the subject of a paper by W. F. Wilkinson, read before the Chemical and Metallurgical Society of South Africa recently. The author discussed, among a number of subjects, that of the life of the mines in the main reef of the Rand, 27½ miles in length. The data which he assumes are very interesting, as showing, among other things, the best scale upon which mining operations in South Africa are conducted. The assumptions are: Depth of mining, 5,000 feet vertical; length of reef on dip, 10,000 feet, on a basis of the Bezuidenville and Rand Victoria's borehole sections; one ton—12 cubic feet; average thickness of reef milled, allowing for waste, 4 feet.

Approximate outcrop distance in feet is	145,750
Million tons to 5,000 feet vertical	486
Estimated value per ton, in shillings (yield)	36 8
Gross value in million pounds sterling.....	892
Profits with working costs at 25s. per ton in millions of pounds	286
Profits with working costs at 20s. per ton in millions of pounds.....	406

The result of this estimate shows that for this part of the Witwatersrand alone a tonnage of 486 (mills) having gold contents of £892,000,000, is available for mining. From these figures the amounts already won must be deducted. It may be useful for reference if similar estimates are given, which have been made from time to time:—



ROTARY ENGINE.

	Year.	Greatest vertical depth. Feet.	Million pounds.	Miles of outcrop.
Hamilton Smith.....	1893	3,000-3,500	325	11½
Schmeisser	1893	3,900	350	11½
Hatch and Hammond	1895	5,000	592	27
Becker	1896	5,000	700	20
Hays Hammond.....	1895	5,000	9 per 1 mile outcrop 1,000 feet depth.	

At the present time (1897) the tonnage milled from the Witwatersrand and district is between four and five million tons a year. Making allowance for the deep-level mines, and assuming that double this amount is removed, we get a life of, roughly, half a century. "This I consider," Mr. Williams concluded, "the very least period that the Rand mining industry will be of first-rate importance."

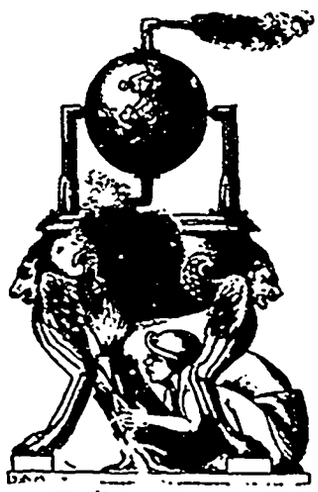
ROTARY ENGINE OF CANADIAN DESIGN.

The origin of the steam engine is now known to belong to a period before history began to record anything but mere political events. Hero of Alexandria produced a manuscript, 120 B.C., in which he describes a number of primitive forms of water and heat engines, and among the latter, that shown in the illustration on next page. This consisted of a globe held between trunnions, the steam entering from the boiler below through one of these. The rotary motion is produced by the reaction of the steam, which escapes from the bent arms. It is supposed by some that this contrivance was actually used by the Greek priests to produce motion in other apparatus. The next rotary engine is probably the model constructed by Denys Papin, in 1690, for working pumps and driving paddle wheels. This consisted of a cylinder and a piston, which was raised by steam pressure, its descent being permitted by the vacuum produced by the condensation of the steam.

Every engineer is aware of the loss of power insep-

arable from the movements of all types of engines now in common use, and most engineers are familiar with the almost innumerable attempts made to get the rotary principle into practical use. So far the enormous consumption of steam has been the point at which all inventors have stuck, and most inventors of rotary engines have encountered further difficulties in designing an engine with parts that will not grind, and yet are steam tight.

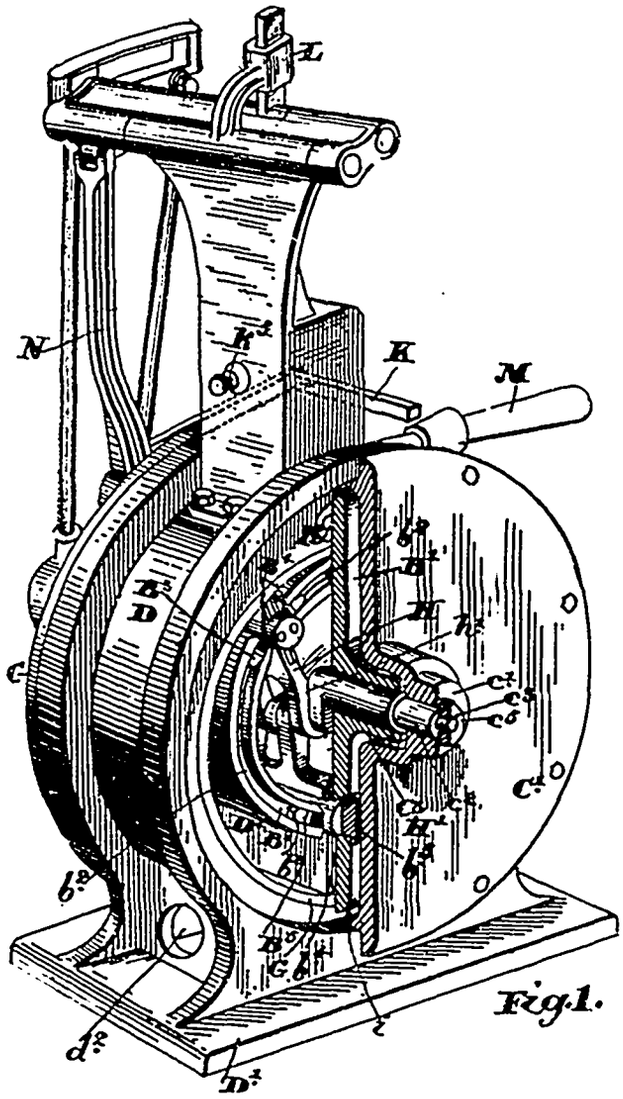
In advance of a scientific test we are not prepared to say that the type of engine we are about to describe surmounts all these difficulties, but a representative of THE CANADIAN ENGINEER visited the works of Messrs. Baird & Tree, at Woodstock recently, and saw a rotary engine that had been in daily use over six months, and when taken apart the internal parts that would be most subject to wear still show the marks of the hand scrapers. This would seem to settle the question of steam-tight chests with absence of grinding. As to the consumption of steam, the inventors and designers of this engine have an ordinary old upright boiler, such as is used on threshing machines, and their consumption of fuel is one and a half cords per week of beech and maple cordwood, running 13½ hours per day. The engine operated by this boiler has a cylinder of 4 inches face and 8¼ inches inside diameter, the ring piston taking up 6½ inches of that. Out of this they estimate that they get eighteen horse-power with steam pressure of one hundred pounds, engine running at nine hundred revolutions per minute. They at first used a four inch rubber belt, but had to change it for a six inch belt and have been operating the following machinery running from two lines of shafts, beside counter shafting: one engine lathe of four feet swing over shears and eighteen feet bed, one engine lathe of twenty-two inch swing and ten feet bed, one engine lathe sixteen inch swing and eight feet bed, one shaper sixteen by twenty-eight inches, one drill press thirty inches, one drill press twenty inches, one set emery wheels; these, we understand, have been all in operation at one time on fifty pounds steam, running at 400 revolutions. This engine is mounted on a light wooden box, and has been run at between 1,400 and 1,500 revolutions per minute with little



HERO'S ROTARY ENGINE

vibration. Our readers will, no doubt, be interested in the forthcoming test of the large new engine of this time, which will take place, we understand, at McGill University, Montreal. Messrs. Tree, Baird and Eldon, the inventors, designers and promoters are all young Canadians.

Fig. 1 shows the external appearance of the engine, with one-half of each of the two circular casings on one side removed, so as to exhibit the inner mechanism. *D* is a hollow cylinder attached to a bed plate D^1; the hollow of the cylinder is not placed centrally in *D*, being dropped down a little, and thus the main shaft does *not* enter at the centre of this hollow. *D* is cored out so as to



ROTARY ENGINE.

leave a flange on each end or side, and to these flanges are bolted two circular casings *C* and C^1, which enclose the two open ends of the cylinder *D*. Into the cylinder *D* is placed the ring piston B^1 (see Fig. 2 and outline), which is a smaller hollow cylinder placed eccentric to the larger one, and in contact with it at the top, thus leaving a crescent-shaped chamber D^4, in which the steam acts. The ends of the ring piston are enclosed by circular casings or discs *B* and B^2 (see Fig. 3), which extend beyond its periphery so as to have a bearing on the larger cylinder *D* just inside of the outer casings *C* and C^1, and thus enclose the crescent-shaped chamber which is made perfectly steam tight by means of automatic adjustable packing. The casings *C* and C^1 of course are stationary, but casings *B* and B^2 revolve with the ring piston on the main shaft, to which they are attached solidly; the ring piston and casing *B* are one piece, the casing B^2 being bolted to the ring piston, and all three are solidly attached to the main shaft *A* (Fig. 3). The main shaft is propelled by means of three wings *H*, *H*, *H* (see Fig. 2) which act on the ring piston.

Figs. 2 and 3 are vertical sections of the engine, the one at right angles to the main shaft and the other parallel to it. They show the relation of the ring piston, the wings, the shafts, etc. In the ring piston B^1 are three slots equi

distant from each other, and in each slot is placed a bronze swivel H^1 (see Fig 4) with an opening h through which

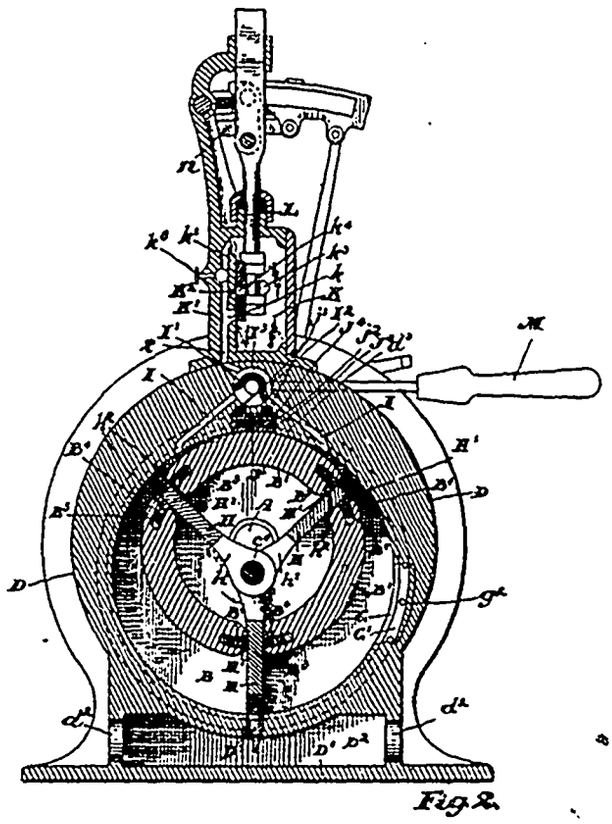


Fig. 2.

the wings slide. Now it will be seen that the main shaft A (see Fig. 3 and outline also) passes through the outer casing C, is solidly attached to the inner casing B, and acts at the centre of the ring piston, projecting into it a very short distance only; also that the outer casing C provides a journal for the shaft. The shaft on which the wings H, H, H rotate is stationary; it is solidly attached to the outer casing C^1 at c^2 on the side opposite to the main shaft; it then becomes a shaft on which the revolving casing B^2 is journalled at C^3; on entering the ring piston hollow it has an offset C^4 and becomes the wing shaft at c^4, acting at the centre of the hollow of the cylinder D, through which the wings sweep.

Fig. 4 shows a section of the ring piston, a slot, a swivel H^1, an opening h for the wings, and the automatic adjustable packing.

Fig. 2 and the outline, or working drawing, also show

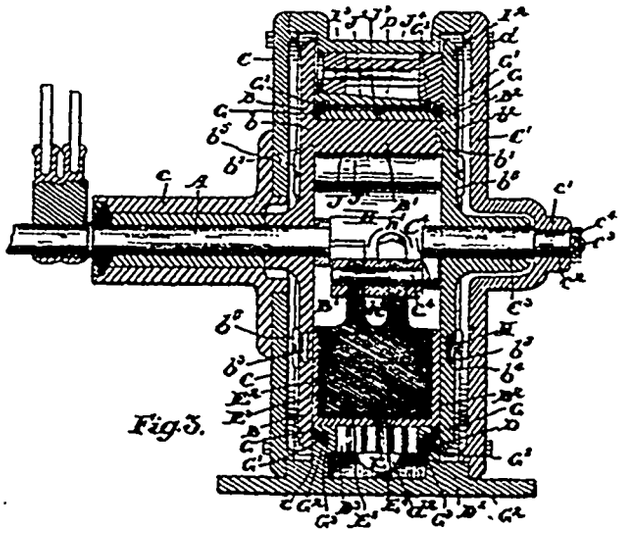


Fig. 3.

the course and the action of the steam. The steam chest K is set in between the flanges of D. The slide valve is worked by means of a link-motion connected with the main shaft by an eccentric shaft (see also Fig. 1). By a novel device the lever M, for reversing the engine, connects with the link motion, and at one stroke reverses the engine. The live steam passes from the steam chest to the reversing plug and onward through a short channel I, entering the crescent-shaped chamber at the port. Notice again that the ring piston is attached to the main shaft, and that the wings rotate on a stationary shaft attached to the side opposite to the main

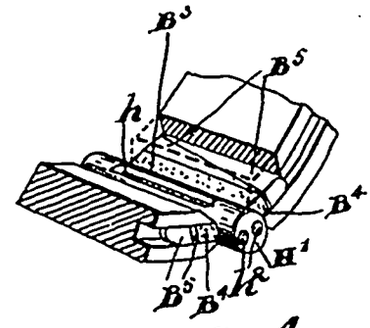


Fig. 4.

shaft, and thus the action of the wings in propelling the ring piston. Now the live steam, entering the port at the narrow part of the crescent, acts on a wing until cut off by the valve, and then expansion acts in the larger part of the crescent until the wing reaches the exhaust port at D^3. As soon as exhaust commences, live steam begins to act on the next wing, the power of the live steam increasing as that of expansion decreases, which gives a constant and a continuous pressure. The slide valve is so arranged that steam may be cut off at any stage, and thus allow live steam to be economized and expansion to be utilized to almost any extent; one up and down stroke of the valve allows steam to act on the three wings in succession. Not only does live steam act in the small part of the chamber and expansion in the large part, and both in treble succession, but as the expanding steam grows weaker its leverage on the wing becomes greater as the wing moves to the port D^3, and thus a further use of expansion. Again, instead of a back pressure at the time of exhaust, there is a forward pressure, for when

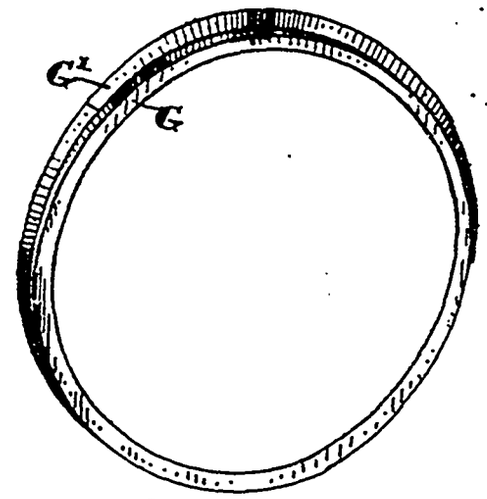


Fig. 5.

the wing passes the exhaust port at D^3, there is a pressure against the wing receding from D^3 as also against the one advancing to this port; but the steam surface of the receding wing is greater than that of the advancing wing, and thus a resultant forward pressure. The port opposite to the one used as an intake is used as a supplementary exhaust for any trifle of steam that may not exhaust at D^3.

Friction in this engine is reduced to a minimum, and perfect steam tightness is secured by means of its revolving casings and novel system of packing. The crescent-shaped chamber is enclosed by the revolving casings B and B^2; these casings do not bear on the face of the cylinder D, although so close that they almost touch it; Fig. 5 shows a couple of V-shaped packing rings which are placed in a groove G^1 (Fig. 2) and which with springs g^2 act automatically in producing steam tightness between the revolving casings and the face of D, and also in reducing friction to the minimum quantity. Again, where the ring piston is in contact with the cylinder D, an automatic adjustable packing block j^3 (Fig 2) is used. Also, it will be clear that the wings in making a revolution do not rub against the sides of the casings B and B^2, as these casings likewise revolve, wings merely slipping in and out against them a short distance; the wings, however, do not touch any portion of the cylinder D in revolving, as they are packed on their sides and ends with two L-shaped pieces and a V-shaped block, adjusted by springs, which again secure perfect steam tightness with a minimum of friction.

ACETYLENE FROM THE UNDERWRITERS' STANDPOINT.

Since calcium carbide has become an article of commerce, and acetylene gas is being employed as an illuminant, especially in country places and small towns where fire protection is inadequate, the conditions under which the carbide may be safely manufactured, handled, and stored, and the resulting acetylene gas produced and employed, has become a matter of the greatest importance to the companies engaged in the business of fire insurance. The underwriters of Ontario have published a set of rules for the use of calcium carbide and acetylene gas which are much more severe than those laid down by the underwriters of Manitoba. The London Ins. Co., London, Ont., the Perth Ins. Co., Stratford, Ont., Wellington of Guelph, and the Millers' and Manufacturers' Ins. Co., Toronto, have secured a special report on calcium carbide and acetylene gas from Prof E. B. Shuttleworth, F.C.S., whose wide experience and recognized ability as a chemist and analyst give his conclusions much weight. We append Prof. Shuttleworth's report:—

In comformity with your instructions I herewith submit the result of a study of acetylene with especial reference to the risks involved in its manufacture and use. When viewed from this standpoint the subject presents certain subdivisions, each of which demands separate consideration, so that the conclusions formed may be directly available for insurance purposes. Before entering upon a discussion of these questions I would explain that as the literature of the subject is, so far, almost exclusively confined to papers and articles which have appeared in technical and scientific periodicals during the past two years, I shall take the opportunity of recording those facts which are likely to prove of interest or value to the underwriter. I propose to present the subject under the following general headings:—Manufacture, storage and carriage of calcium carbide; manufacture of acetylene at low pressures; use of low pressure acetylene for illuminating purposes; use of compresses or liquefied acetylene for illuminating purposes.

MANUFACTURE OF CALCIUM CARBIDE.

The preparation of carbide as carried on under the Willson process, patented in 1894, consists in submitting a mixture of powdered lime and charcoal, or coke, to the heat of a powerful electrical furnace, in which the temperature probably reaches 10,000° F. The lime, which chemically speaking, is oxide of calcium, is decomposed, the oxygen being replaced by carbon. In the ordinary working scale it requires about six hours to effect the change. The result being a pig of fused carbide weighing about 500 pounds. The mass is removed by a hydraulic crane and allowed to cool. This requires about two days, when the carbide is broken up, by sledges, into pieces which will pass through a 5-inch opening, and is packed in strong tins furnished with a screw-cap and generally holding 100 pounds. These tins are afterwards encased, in pairs, in a strong wooden box. This is the plan pursued at the Willson Carbide Works, on the Welland Canal, at Merritton, from which the Canadian supply of carbide is, in great part, derived. On October 29th, by invitation of the inventor, I had the privilege of thoroughly inspecting the entire works and witnessing all phases of the manufacture. These works commenced operations in August, 1896, and are now turning out about sixteen pigs, or about four tons, per day. A second factory is almost completed, at a lock lower down the canal, and a third is being built still further below. The energy at command in these establishments will equal over 1,500 horse-power. The factories cost about $30,000 each.

The carbide produced is in exceedingly hard pieces, of a grayish-black color; semi-crystalline in structure; about two and a half times heavier than water (sp. gr. 2.26). Commercial carbide is never pure, that of good quality containing 80 to 90 per cent. of the true compound. It is liable to contain calcium phosphide, an impurity which, in the production of acetylene, may give rise to spontaneously inflammable gas, and thus cause accident. This will be afterwards alluded to. Analyses of European carbide have sometimes shown as much as 3 per cent. of phosphide, derived from impure lime, or coke. It is claimed that the Canadian product is made from lime which contains only 0.96 of impurity, other than magnesia, and that, as far as known, it is free from phosphide. This would have to be determined by actual analysis. Carbide is not inflammable, does not explode by friction or shock, as abundantly evidenced by the rough handling it receives in breaking. It is not affected by dry steam, but when exposed to the air, quickly combines with the watery vapor present, and gradually evolves the gas, acetylene. This is formed by union with the hydrogen of the water, the oxygen and part of the hydrogen combining with the calcium, thus producing slaked lime. In other words, carbide of calcium, plus water, yields hydrate of calcium, plus acetylene. In the presence of moist air this change goes on very slowly, as the coating of lime formed on the lumps of carbide acts as a protective. The gas generated passes off into the air, and under practical conditions, as in carbide works, is not at all likely to do harm, It has been asserted that when a quantity of powdered carbide is brought into contact with a relatively small amount of water, the heat produced is sufficient to ignite the liberated acetylene, but I have not been able to bring about this result at ordinary air pressures. The heat liberated is, no doubt, carried off by the watery vapor generated, and the temperature does not, therefore, rise above boiling.

In the Merritton, Ont., works there were in the same room four electrical furnaces, in active operation, with their attendant heat and flame; on the floor were at least twenty pigs of carbide, some of them white hot, and several resting in shallow pools of water formed from leaks in the hydraulic hoist apparatus. I was informed that from August, 1896, until Jan., 1897, the pigs of carbide were not cooled by exposure to air, as at present, but by playing on them with a hose. The risks of percussion

were fully represented by the sledge-hammer blows constantly falling on the lumps of carbide, and I saw no evidence of the production of flame in this way, as stated by one author. None of the window openings were fitted with sashes, and in rainy weather, accompanied with wind, much water would, undoubtedly, blow on to the carbide distributed over the floor. Radiated heat, heat of percussion, flame, and water, existed concurrently in this apartment, but no injury resulted, and I was assured by Mr. Willson that none had been realized, or was anticipated.

I believe that buildings for the manufacture of carbide should for insurance purposes, occupy a position combining the conditions present in foundries, and places where electrical energy is developed. They should be built with fireproof walls, preferably of corrugated iron; be well ventilated and lofty, so as to provide for the quick and complete dilution, and rapid escape of any evolved gases.

STORAGE OF CARBIDE.

Much of what has been just stated is applicable to the question of the storage of carbide. In the absence of water the compound is no more dangerous than is so much limestone. With water there is the formation of acetylene gas, but, except pressure is thus generated—a condition which, under such circumstances, is difficult of fulfillment—there is practically no liability to accident in the absence of flame. Water and fire together constitute the element of danger, while in the case of gunpowder and other explosives, and with inflammable liquids, as alcohol, gasoline, turpentine, etc., the latter is alone sufficient. The difference in risk is in some degree proportional to the probability of a co existence of the disturbing conditions. At the time that the fire took place at the Polson Works, at the foot of Sherbourne street, Toronto, there were standing in the building two tins containing carbide. The heat was sufficient to melt the solder of the tins, but the carbide was quite unaffected It is not likely that this would have been the case with gunpowder, varnish, coal oil, or any of the liquids mentioned. In the furnace room of the Willson Carbide Works, already described, there was stored, at the time of my visit, some 80 tons of carbide, packed in tins and cases, and piled about ten tiers high. This was stated to be a small stock, and supplies of carbide had been stored here for more than a year, without accident, though fire and water were always in close proximity.

I am of opinion, with proper provision for keeping the carbide in substantial, properly sealed, water-tight, metallic cases, enclosed in wood in order to protect the tins from external violence, and the storing of such packages in a well-ventilated apartment, the risk would not at most be greater than with ordinary inflammable liquids.

CARRIAGE OF CARBIDE.

This question may for the most part be decided by the arguments already brought forward, but there is introduced a new element of danger in the transmission of the carbide by water, where there is a possibility of partial or complete submergence in that element, and where packages might be stored in the unventilated, damp holds of vessels. From imperfect sealing there might be slow evolution, with consequent accumulation of gas, which, by admixture with air and subsequent contact with flame, might produce explosion. In order to test whether the ordinary commercial package was impervious to water an experiment was made at the Merritton Works, of which the details were communicated to me. Two 100 lb. tins were suspended for several days in the tail-race, where they were completely immersed and subjected to some motion. At the close of the trial one of the tins had suffered a loss of six pounds of the carbide, and the other was intact.

I desired to ascertain whether the sudden inrush of water, and the subsequent application of flame, would give rise to explosion of an ordinary commercial package. I therefore made an experiment, which, from the quantity of carbide operated upon, might be considered of an ultra-crucial character. A full 100-lb. package was selected at random from a large number. The tin was 12 inches square by 18 inches in height, and was made of IXX sheet-steel of 27 gauge, with an opening of five inches closed by a screw-cap. The cover was removed, a gallon of water instantly dashed in, and a light applied. The result could not in any sense be called an explosion. There was a sudden ignition of the evolved gas, which continued to burn quietly to the height of about 18 inches for 10 or 15 minutes, when more water was thrown in, producing a slight increase of flame. The gas continued to burn for about half an hour. The heat produced was only sufficient to melt the solder off the screw collar at the top of the tin. There was some diminution in the bulk of the carbide, but the larger pieces remained intact, and when the crust of lime was brushed off, were otherwise unchanged. The experiment clearly demonstrated that, under the trying conditions described, the ignition of the gas from the admixture of relatively large quantities of carbide and water would not give rise to an explosion, while the combustion was not more uncontrollable than would have been the case with many inflammable liquids.

I think that the carriage of carbide in the close holds of vessels should be subject to restrictions, and is attended with some risk.

MANUFACTURE AND USE OF ACETYLENE AT LOW PRESSURES.

The manufacture and use of acetylene at low pressures, slightly over that of the air, and not exceeding say 1½ ozs. to the square inch, must be considered separately from that of more strongly compressed or liquefied gas. The latter are of a much more unstable and dangerous character, and their behavior towards disturbing agencies is, so far, imperfectly understood. Acetylene, as before stated, is produced by bringing calcium carbide in contact with water. One pound of carbide should yield, theoretically, over 5½ cubic feet of gas, but owing to the impurity and deterioration of the carbide, only about five feet are produced, manufacturers usually guaranteeing 4.66 feet. The reaction is very vigorous, gas being liberated with great rapidity, and with the formation of much heat.

The gas is of specific gravity, 0.91, and is, therefore, nearly one-tenth lighter than air and about twice as heavy as coal gas. It possesses a peculiar and disagreeable odor—a character which serves as a useful warning of its presence, and the consequent detection of leaks. At air temperatures it can be liquefied by a pressure of about 600 pounds to the square inch, and by extreme cold can be solidified. Acetylene is stated to be more inflammable than any other gas, not even excepting hydrogen. The point of ignition is about 900°, that of coal gas being near 1,400°. The flame produced is exceedingly luminous, being variously estimated at 10 to 20 greater than that emitted in the combustion of an equal volume of ordinary gas. The products formed are mainly carbonic acid and water, with little if any combustible gas containing carbon. These products, as also the heat generated from flames of equal luminosity, are much less with acetylene than coal gas, or carburetted water gas. When acetylene

is mixed with air in the proportion of three per cent. of the former, the mixture begins to be slightly explosive; at little over eight per cent. the maximum explosive effect is reached, and when the acetylene reaches eighty-five per cent. explosiveness ceases. With coal gas the limits of explosion are between five and twenty-eight per cent, and with water gas from nine to fifty-five per cent. The maximum explosive effect with acetylene is reached when the proportion is 1 to 12 of air; with coal gas, 1 to 6; and water gas, 1 to 1. It is thus evident that acetylene begins to be explosive with a less admixture of air than either water or coal gas, and that it retains its explosiveness through a greater range.

If acetylene, at a pressure of over two atmospheres, is heated to 1,437° F., it is dissociated or resolved into its constituent elements, carbon and hydrogen, the former being deposited. Dissociation is accompanied by the sudden liberation of much heat, with a corresponding rise of pressure, and consequent explosive effect. While acetylene, without admixture of air, is strongly explosive, it must be remembered that in the experiments by which this was established, the gas was always under pressure, and in most cases was heated by the container being placed directly over a flame of fire. It has not been shown that at air pressure the gas can be exploded by heat, shock, detonation, the electric spark or by a white-hot platinum wire. Though decomposition may be thus set up it is confined to the point of disturbance, and is not propagated to the mass of the gas. It is asserted that this result will not follow so long as the gas is under pressure of less than two atmospheres. If acetylene at low pressures be confined in a receiver from which a pipe passes, the end of which is closed; and at a distance of five feet from the receiver the pipe be heated to 1,437° F., sudden decomposition, accompanied by sudden pressure, will take place. If acetylene be passed through a hot porcelain tube its constituents are polymerized, or rearranged, so that the product is no longer acetylene, but may appear as naphthalene, or other solid or semi-solid hydrocarbon. This is the result of heat on uncompressed gas, and indicates a danger in the blocking up of pipes and burners traversed by heated acetylene.

The impurities of acetylene are due to foreign matter in the carbide, and as far as relates to the subject of this investigation, are phosphuretted hydrogen, siliciuretted hydrogen, and ammonia. The two former are spontaneously inflammable, and are thus a source of danger, while the latter may attack copper or brass portions of the apparatus, which, by subsequent contact with moist gas may form explosive compounds. These compounds consist mainly of cuprous acetylide, and do not appear to be formed except the copper or alloy is oxidized, or perhaps only when an ammoniacal compound is generated. Pure, dry acetylene does not combine with copper. The copper salts are very sensitive to shock, friction, or heat, and when exploded may serve as detonators, though, as previously stated, the explosion in uncompressed gas would be merely local, but under 30 lbs. to the inch the impulse would be transmitted to the mass of acetylene.

The above facts thus briefly summarized, point out certain dangers to which the manufacture and use of low pressure acetylene is liable. They may be enumerated as follows, an attempt having been made at arrangement in sequence of importance:—

1. Formation of explosive mixtures of acetylene and air, as produced by defects in generating apparatus, or escape of gas through fixtures. 2. Production of heat and pressure by the too rapid decomposition of the carbide. 3. Secondary formation of gas by watery vapor, or the dehydration of slaked lime by the carbide, after the conclusion of the ordinary process. 4. Generation of dangerous pressures in apparatus insufficiently provided with relief attachments. 5. Formation of explosive compounds with copper or its alloys. 6. Production of spontaneously inflammable gases originating in impurities in the carbide. 7. Blocking of pipes by solid hydrocarbons resulting from polymerization of acetylene. 8. Evolution of gas from imperfectly exhausted carbide residues.

Before discussing these points, it may be said that the apparatus for generating acetylene consists primarily in an appliance for producing the gas, and a receiver for holding it for distribution. Generators are of two kinds. In one the carbide is brought in contact with a relatively small quantity of water, projected automatically; in the other, the carbide is put into a relatively large quantity of water.

(1). Acetylene, as has been shown, forms an explosive mixture with air, as do other illuminating gases. The question is merely that of degree, and this is indicated by the figures given, but it must also be remembered that the acetylene mixture is more powerfully explosive than are those of the other gases. In forming a general conclusion, the fact of the different diffusibilities of the gases must also be taken into account. Coal gas, on account of its lower specific gravity, would issue much more rapidly from a leak than would acetylene, but against this must be set the fact that the latter, being much heavier than coal gas, would be more liable to accumulate in badly ventilated spaces. In the case of escape of gas from an unlit, open burner, the quantity of acetylene would be much less than that of coal gas, not only for the reason stated, but on account of the diminished capacity of acetylene burners, which only allow about one cubic foot to pass per hour, while those for coal gas are usually arranged for five times this volume. When these facts are balanced against one another the danger of accident from explosive mixtures with air does not appear to be appreciably greater with acetylene than with coal gas.

(2) That explosion, by dissociation, is possible from a too rapid decomposition of carbide seems to have been domonstrated by good authorities in Europe. I have repeated some of the experiments made, in one case operating on ten pounds of carbide, but, perhaps fortunately, without confirming the results obtained by others. The fact that carbide will not combine with dry steam at a high temperature is against the theory of explosion, which necessitates the presumption of a temperature of 1,437° F., as determined by Gerdes, of Pintsche's laboratory. If a lump of carbide be heated on an open fire and sprinkled with water, inflammable gas is not produced. In view, however, of our somewhat uncertain knowledge of commercial carbide, under such circumstances, it is necessary to make provision against possible accidents, and this is, no doubt, one of the objects sought by generator manufacturers. With properly constructed apparatus the danger of accident might be entirely obviated.

(3) The secondary production of gas, after the first effect of the addition of water to carbide has taken place, may always be observed. The heat of the reaction generates steam, which mixes with the gas in the generator, and afterwards condenses on the carbide, thus giving rise to a second, but relatively feebler evolution of gas. The affinity of carbide for water is also so great that it will dehydrate the slaked lime, with which each lump of carbide is coated, thus bringing about slow production of gas. While consumption from the receiver is going on there is

not much likelihood of the accumulation of pressure, but if the gas is not being used such result would follow, but could be provided for by a relief valve, or water seal, opening outside the premises. The danger, like the former, is dependent on the construction of the apparatus.

(4) Dangerous pressures, from any cause, can be similarly met.

(5) With regard to the presence of explosive copper compounds, it has been shown that such are dangerous in acetylene at high pressures. But authorities agree that at air pressure, and when not exceeding two atmospheres, the effect of such disturbing agents is that of only bringing about local detonation, which is not transmitted to the body of the gas. It has been proved that the presence of ammonia is the prime cause of the formation of these copper salts and provision might be made against danger by the avoidance of copper or brass in the construction of apparatus.

(6) Several explosions of compressed acetylene are reported as having possibly originated in phosphuretted or siliciuretted hydrogen generated from impure carbide. It is likely that such might be dangerous constituents of low pressure gas. In view of this some provision for the inspection or analysis of carbide should be put in force. This might take the form of a guarantee of purity furnished by manufacturers.

(7) The blocking of pipes by solid hydrocarbons, as naphthalene is common enough where water gas is wholly or in part used, as in Toronto. In the case of acetylene the danger would not be as great, and with properly constructed generators and burners need not be realized at all.

(8) There is some possibility that in the residue from generators there might be small pieces of undecomposed carbide mixed with the lime. These would slowly give off gas, which, by contact with flame, would, it is thought, be a source of danger. I have examined such residues, taken from a large generator while in action, but could not succeed in detecting, by flame test, the presence of inflammable gas. Generators are mostly fitted, for economic reasons, with a grating, which only permits of a passage of small pieces of carbide, or residue. I do not think such residues are as dangerous as wood ashes as removed from domestic stoves. The above enumeration fairly exhausts the list of risks involved in the manufacture and use of low pressure acetylene. The next point of enquiry is that of ascertaining whether these dangers have been actually realized. In order to carry out this purpose I have searched for records of accidents the files of likely periodicals, and have succeeded in finding notes of a few cases, though in most of the accounts the information is meagre, and in some instances indefinite, especially as to the state of compression of the gas. To these you will doubtless be able to add others from insurance records. The following is not given as being complete, but simply comprising all the cases which I have been able to find:

Accident alluded to by Smithells, in remarks on Berthelot and Vieille's communication to the French Academy of Science. Carbide in generator thought to have become incandescent from insufficient supply of water. Particulars not given, nor pressure of gas stated. A plumber at Egremont, Cheshire, constructed and used an acetylene apparatus. Supposing the "receiver" to be empty he took off the cover, the result being an explosion by which he was so much injured that death shortly after resulted. The coroner thought the explosion was caused by the admixture of air with the gas remaining in the receiver. There is here a possibility of the presence of spontaneously inflammable phosphoretted hydrogen. Infante reports the explosion of a home-made apparatus. Smithells thinks that it was due to phosphoretted hydrogen, and that the receiver contained air. Two explosions took place in New York from the escape of gas from acetylene apparatus. The presence of flame might here be presumed. Another New York accident resulted from the cover of a generator being removed while a lighted candle was in close proximity. An explosion is said to have taken place lately at Arkona, Ontario, by which several persons were slightly injured. The owner is stated to have been in the act of showing the apparatus to some of his friends, a lamp being used as a source of illumination. Explosion followed the removal of the cover of the generator. The last four accidents evidently took place with low pressure acetylene, and were all probably due to the proximity of flame. This indicates what I believe will prove to be the chief source of danger.

GENERAL CONCLUSIONS.

(1) Calcium carbide factories may be classed in the same category as iron foundries, with the additional risk incident to electrical plant.

(2) The storage of carbide should be subject to the conditions governing that of inflammable liquids. Packages to be of sheet steel, of at least twenty-seven gauge, well tinned, having seamed and soldered joints, and furnished with water-tight metallic caps. Packages to be further protected by being enclosed in strong wooden cases. Place of storage to be well ventilated, dry and well drained.

(3) Carriage of carbide, by water, to be held to involve extra risk.

(4) Carbide to be free from phosphoretted or siliciuretted compounds, as determined by analysis, or assured by guarantee.

(5) Apparatus for generating acetylene to be inspected and approved before use, and to embody certain general features of construction to be hereafter specified.

(6) Rooms for the installment of apparatus to be well drained, free from dampness, and provided with sufficient overhead ventilation communicating directly with the open air. No fire, flame, or artificial light to be allowed in apparatus room, nor are such places to be used for any other purposes than that indicated.

(7) Manufacture of gas to be carried out by a properly instructed and capable person, and never to be attempted except by daylight.

(8) Residues from generator to be removed by daylight, and directly deposited at a proper distance from any building.

(9) The use of acetylene gas, for lighting purposes, need not be placed under any special restrictions when the apparatus is not located in the building, and at a safe distance from it.

USE OF COMPRESSED AND LIQUID ACETYLENE AND CARBIDE LAMPS.

It is more than probable that this question will, in time, become of considerable moment, and demand attention. In view, however, of the serious accidents which have already occurred, even in the laboratories of the most experienced gas chemists; and until the peculiarities of compressed and liquid acetylene are more perfectly understood, and better control apparatus has been devised, I think the underwriter may most profitably decline all business involving risk with these dangerous substances.

I have formulated, and herewith enclose a draft of regulations governing the installation and use of gas machines. I have the honor to be, Sir,

Your obedient servant,

E. B. SHUTTLEWORTH.

Toronto, Nov. 12th, 1897.

RULES FOR THE INSTALLATION AND USE OF ACETYLENE GAS APPARATUS.

(1) No generating apparatus shall be installed without the approval of the company has been obtained. Such approval shall only be granted after proper inspection by a qualified person appointed by the company. Makers of apparatus may have any particular design inspected, and to this end shall submit the necessary drawings and specifications and shall provide facilities for examining and testing the machine. If the inspection prove satisfactory the approval of the company to this particular form of apparatus may be secured provided the manufacturer signs an undertaking that the construction and design of such apparatus shall remain unchanged and in conformity with the drawings and specifications deposited with the company. The cost of inspection must be borne by the party who makes the application. Approved apparatus shall embody the following features: Generator and gas holder to be of proper relative proportions, and both of sufficient capacity for the requirements of the gas consumption of one day. Generator, gas holders and connections to be substantial; not subject to corrosion, and free from any parts of copper or its alloys. Pipes and connections to be of sufficient size and not subject to clogging. Adequate provision by liquid seals for the relief of gas pressure greater than that of three inches of water; and for the free discharge of surplus gas in the open air. Reliable automatic device for bringing the carbide into contact with the proper quantity of water.

(2) Location of apparatus. No apparatus shall be put into operation in a room in which there is a fire, or where any artificial light is used, even momentarily; or where the temperature is liable to fall below the freezing point. Apparatus room shall not be used for any purpose other than the manufacture of gas, and the storage of the necessary quantity of carbide. They shall be well drained, free from dampness, and provided with sufficient over-head ventilation communicating directly with the open air.

(3) Working of apparatus. All operations shall be conducted by daylight, and only by persons properly instructed in such work, and whose qualifications have been approved by the company. Residues from generators shall be removed by daylight and at once deposited at a safe distance from any wooden building.

(4) Storage of carbide. Carbide for use must be of guaranteed quality; stored in packages of sheet steel of at least 27 guage well-tinned, having seamed and soldered joints, and furnished with water-tight metallic caps. Such must be kept only in the apparatus room.

(5) The manufacture and use of acetylene at higher pressure than that of three inches of water is absolutely prohibited. This restriction to extend to carbide lamps.

—The Ontario Government still has the power question before it, and from present indications some measure of relief is contemplated. It is impossible for a Government which showed such wisdom in its timber policy to stultify itself by continuing its old anti-Canadian policy.

—A correspondent informs us that he has been making experiments with acetylene gas as a motive power for gas engines, and finds that when running at high speeds, he can get more power out of acetylene gas than out of coal gas. Experiments were made in a rotary engine, and showed that quicker explosions could be got from acetylene than from coal gas. When running at speeds under 300 revolutions per minute, the difference is not much, if any, in favor of acetylene; but at 450 revolutions per minute the advantage is quite marked, and by getting heavier compression he has been able to run the speed up to 750 revolutions per minute, with marked results in favor of acetylene.

—The good things of Canada are, perhaps, after all to be preserved for Canadians, and the resources of our country used to develop it. The Ontario Government has followed out the policy outlined in THE CANADIAN ENGINEER and the press generally, and has passed a bill obliging the holders of new timber licenses to manufacture the logs they cut in Canadian territory by Canadian labor and on Canadian soil. The Dominion Government has, it is just announced, decided to limit the exportation of natural gas. If sufficient pressure can be brought upon the Dominion Government to induce it to bring into operation duties against the export of unrefined nickel, we may see prosperity ahead of Canada at last.

—McGill University is once more to be indebted to W. C. McDonald for princely gifts. He recently announced his intention of endowing a second chair of Chemistry with $200,000. This, added to the former gifts of the Chemistry building, equipment, maintenance, and the endowment of the professorship, makes a total of $575,000 to this department. The Faculty of Law is also to be fortified by the addition of $50,000 to the endowment of $150,000 furnished a few years ago. In addition to this Mr. McDonald intends to institute an auxiliary fund of $200,000 to be used for the general needs of those departments which are connected with his name. Mr. McDonald's gifts to McGill now amount to nearly one and a half millions.

THE MICHIPICOTEN GOLD FIELDS.

The Ontario Government in September commissioned A. B. Willmott, M.A., B.Sc., to examine the Michipicoten mining division, which had just been created, owing to the reports received by the Government of extensive finds of gold in that neighborhood. The following paragraphs are condensed from Prof. Willmott's report to the Bureau of Mines, recently issued by it in pamphlet form:

"Except a very small area at Cape Gargantua the rocks of the Michipicoten division belong to the Laurentian and Huronian systems. Of the former system, the almost universal rock is gray gneiss, finely grained, and not particularly well stratified. At many places it becomes thoroughly granitic in structure, and then is often coarser-grained. At a few places it was quite pegmatitic. While usually a dull grey in color, there are limited localities where a red felspar has given brighter tone to the rock. Syenites are found in small areas. The Huronian rocks are more varied in character. Massive diorites, diabases and hornblende, and chlorite schists are most common. Slates, felsites, quartz porphyries, quartzites and sericite schists are less common. Occasionally conglomerates were seen. At the contact between the two it always appears that the Laurentian gneiss or granite has been erupted into the Hurohian rock, and is therefore later in age. The schists are nearly always vertical, and strike in various directions, depending on their relation to the intrusive granites. No clear distinction could be seen in the field between eruptive granites and the ordinary gneiss, and no case was observed where a granite had been erupted in the gneiss. Dikes of diorite are, however, frequently found in both the Laurentian and Huronian rocks.

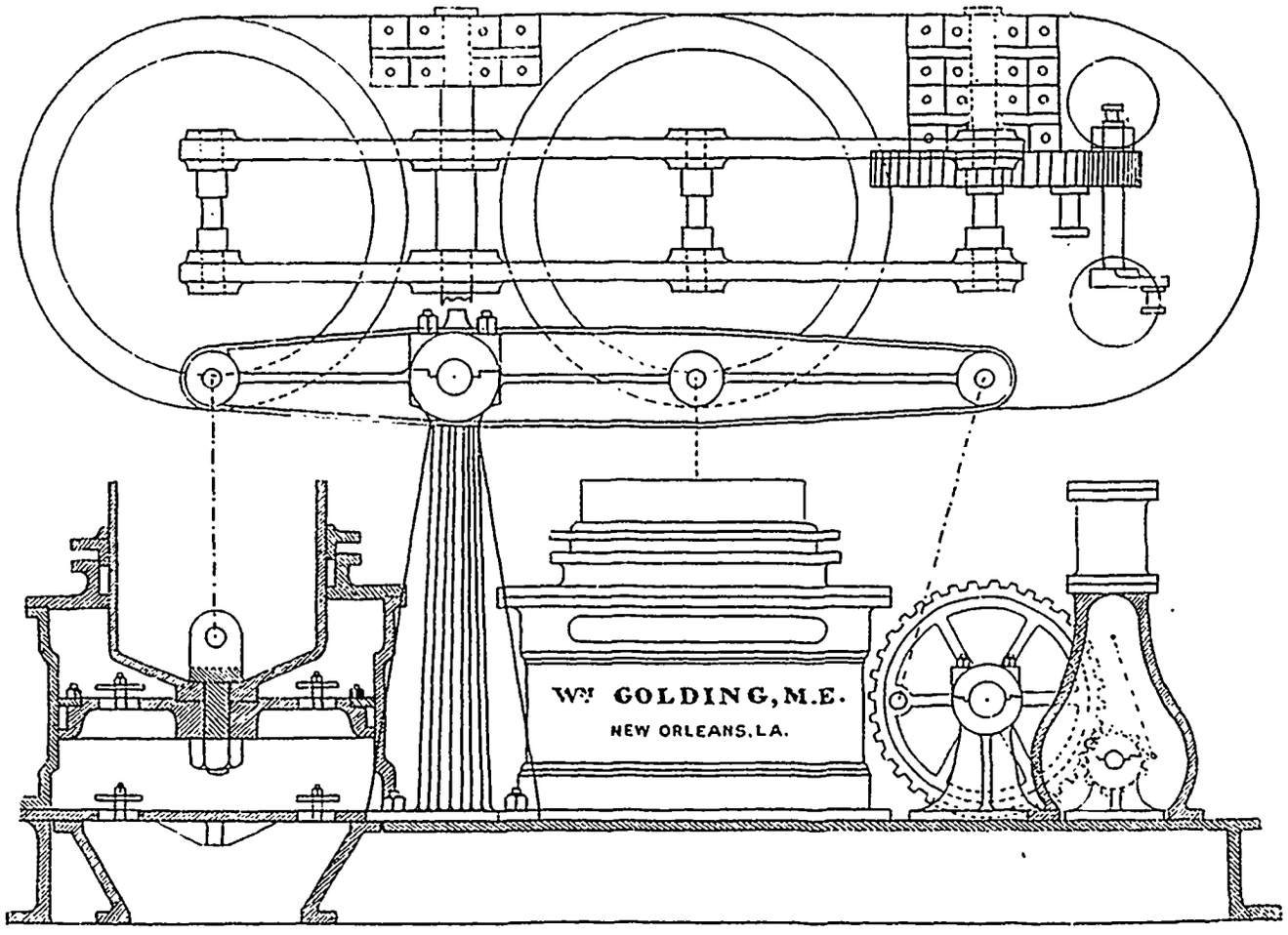
The metal most likely to be found in large amounts in this district, is gold, though discoveries of nickel, iron, copper and silver have also been reported. Almost nothing is yet known definitely as to the occurrence of any of these. Gold has been found at a number of places in visible particles, and in all cases simply chipped from the surface. At no place in the division has a pit been sunk to a depth of over ten feet, and in all the recent prospecting for gold not more than a single shot has been put in at any one point. What little prospecting has been done has been entirely confined to Lake Wawa and the canoe route north to Missanabie. Even here few men have gone more than three miles inland. At the most, a strip

six miles wide by forty long has been examined, and this in the most superficial manner, for several reasons. Many of the prospectors who have recently turned their attention to the field are utterly unfitted for the task. Fully three-fourths of those I met did not know how to pan, and could not tell when they had quartz of value," says Prof. Willmott. "Even for experienced woodsmen this region is a hard one to prospect. The cliffs are so steep, and in some regions the rocks are so completely enshrouded in moss that it takes days to prospect a very small area. The number of quartz veins seems to be large, to judge from reports given me by prospectors. Many of those I saw were very wide, and not infrequently formed the precipitous sides of high cliffs. In this case they are somewhat easily traced, often for a considerable distance. In nearly every case the veins are bedded ones, following the strike of the schists. On the whole the quartz seems white and does not usually carry any large amount of sulphides. Iron and copper pyrites are the chief minerals of the quartz, though galena and pyrrhotite are occasionally found.

So far the best finds are in the vicinity of Wawa Lake and on Manitowick Lake. Similar country rocks are, however, widely spread, and equally good deposits are quite as likely to be discovered in the future. Only a fringe has yet been prospected. As to placer gold, the early reports have proved to be false. The present streams are but reassorting glacial drift, and it is not probable that gold will be found in their beds. As to their old valleys, the case may be different, but no one has yet reached them. As to other minerals, little can be said. Native copper occurs in considerable amounts on Michipicoten Island, in the formation which on the south shore is proving so remunerative. Cape Gargantua is composed of the same formation."

IRRIGATING PUMP.

The accompanying illustration shows a type of pump, suitable for moving either air or water, and designed especially for irrigating or draining land, where the lift is beyond the economic capacity of the centrifugal pump, and where large volumes are required to be moved. The feature of this combination is, that it can be operated by any power available, either by electricity or by a small steam or oil engine. The pump portion is of the type known as the "bucket plunger," The plunger, being one-half the area of the cylinder, will displace one-half the volume, while descending, and one-half while ascending, thus effecting a continuous discharge. The suction pipe to each will be independent, so that one pump can be used for circulating, while the other is being used for vacuum or other purposes. As will be observed, the combination is entirely self-contained, and may be lightened to any extent for facility of transportation. The engraving is made to scale of half-inch to the foot, for a combination having capacity to move five thousand gallons per minute. This pump is designed by Wm. Golding, M.E., New Orleans.



THE GEOLOGICAL SOCIETY OF AMERICA.

The tenth annual meeting of the Geological Society of America was held in the Redpath Museum, McGill University, Montreal, from 28th to 30th of December.

The ballot for the election of officers resulted as follows: President, J. J. Stevenson, New York city; First Vice-President, B. K. Emerson, Amherst, Mass.; Second Vice-President, G. M. Dawson, Ottawa; Secretary, H. L. Fairchild, Rochester, N.Y.; Treasurer, I. C. White, Morgantown, W. Va.; Editor, J. Stanley-Brown, Washington, D.C.; Librarian, H. P. Cushing, Cleveland, Ohio; Councilors—W. M. Davis (for unexpired term of B. K. Emerson); Robert Bell, Ottawa; M. E. Wadsworth, Houghton, Mich.

At the evening meeting Dr. Dawson introduced the retiring president, Dr. Edward Orton, who delivered the annual address, selecting for his subject the "Geological Probabilities as to Petroleum." He referred to Sir William Dawson as standing high in the list of those who had preceded him in office, and said that, standing within the precincts of McGill University, they might adopt the words: "Si Monumentum requiris, circumspice." He then proceeded to point out some of the principal geological probabilities as to petroleum and its derivatives, and stated that the subject he had chosen for his address had some peculiar claims on geologists. Petroleum was a form of stored power, and geologists knew better than other

men the priceless value of such accumulations Geologists knew that on them the well-being and progress of the race largely depended, and that without them civilization could not long maintain the pace which the nineteenth century had set They knew that these stocks of buried light, heat, and power were small at the best, and that they demanded the most careful husbandry They knew, too, that petroleum and its derivatives, by virtue of their essential characteristics, were especially opposed to waste, either through ignorance, recklessness, or speculative greed, or through all combined. It would be a reproach to have the experience of Pittsburg and some other places indefinitely repeated, it would be a lasting reproach to have the important exploitation of petroleum restricted by the exhaustion of its stocks before the end of the century in which it was begun, and fifty years of which still remained.

The programme included some thirty papers, and of those most interesting to our readers, Prof. Chamberlain read one by Prof. Warren Upham, on "The Niagara Gorge and St. David's Channel." The writer said that having recently again examined the Niagara Falls and gorge, with especial reference to the older channel of St. David's, the author believes that a most important element in the history of the gorge erosion has been overlooked by some observers, and that by others its evidences have been misunderstood This paper shows that the small preglacial stream which eroded the St. Davids and Whirlpool channel, having a great depth beneath the river in the whirlpool, must have flowed for a considerable distance, before reaching that depth, in a gradually widening and deepening ravine, coinciding with the present gorge along the Whirlpool rapids. Because the Niagara River found there a drift-filled, narrow ravine, which it cut to the present size of the gorge, its erosion took place in that part by rapids and cascades. Southward from the head of the old ravine, the river has eroded its gorge by a great vertical cataract, under which the masses of the Niagara limestone, rolled about by the power of the waterfall, have worn the river bed to a maximum depth of nearly 200 feet beneath the water surface. The narrowness of the gorge along the Whirlpool Rapids is therefore attributed to the conditions of the river erosion here indicated, rather than to decrease of the volume of the river by diversion of the water of the upper lakes to flow from Lake Huron eastward. Studies of the glacial Lake Agassiz convince the author that the progress of the epeirogenic uplift of the northern United States and Canada from the Champlain depression was too rapid to accord with the hypothesis of any outflow from Lake Huron toward the east during the long time that would be required for the Niagara River, while thus diminished, to erode the gorge along the Whirlpool Rapids The explanation here given accords mainly with Dr Julius Pohlman's discussion of the Niagara history, but differs concerning the age of the river and of postglacial time, which is estimated, as from Prof. N. H. Winchell's discussion of the Falls of St Anthony, to have been between 5,000 and 10,000 years.

Frank B Taylor, of Fort Wayne, Ind., contributed some "Notes on the Moraines of the Georgian Bay Lobe of Ice-sheet" He said, when the ice-sheet had retreated in the basin of Lake Huron so far as to leave the summit of Blue Mountain, south of Georgian Bay, uncovered, there still remained a well defined glacial lobe projecting towards the southeast, nearly to Toronto and eastward beyond Lake Simcoe. This lobe was divided in two parts by the Penetang peninsula, the larger one extending southeast from Nottawasaga Bay, and the smaller one extending east, southeast from Matchedash Bay. Recently the moraines of the eastern limb of the Nottawasaga lobe were partially explored and a well defined series of five moraines was found filling the interval from the head of Georgian Bay to the "Oak ridges" north of Toronto. During the later stages of this lobe there was a glacial lake covering Lake Simcoe and a considerable area to the east, and probably held up on that side by a lobe projecting from the north-east up the valley of the Trent River. Its beach is 90 to 100 feet above Georgian Bay, running S. 60 deg. E. Some of the moraines running along the east side of Lake Huron were also traced northward to the vicinity of Durham and Flesherton.

Prof. F. D. Adams, of McGill University, read some notes on the "Geology of Montreal and Vicinity." All of these papers were purely technical in their character, and were chiefly interesting to scientific men in general and geologists in particular. Prof. Adams' paper was a most exhaustive one, and dealt with the geological formations of this portion of Canada from the post-pliocene period onward He especially drew attention to the volcanic nature of the district of Montreal, to the large deposits of Trenton limestone and Utica shale to be found hereabouts; to the presence of marine fossils at the base of the mountain, which, he said, went to show that the district now lying between the river and the mountain was at one time submerged in water and ice, thus making an island out of the mountain. The first shore line was in the middle of Beaver Hall Hill, the next at Dorchester street, and another at Sherbrooke street, besides several others, at which heights the river had remained for some time. The mountain is 800 feet high, and the highest shore line is 625 feet high, so that when the water was at its highest there was always a small island. He also pointed out the character of the different stratas of the earth and rock which had been met with in excavating the foundations of Montreal's principal buildings, and in conclusion gave a brief summary of the topography of the island and the changes which had taken place therein since the days of Maisonneuve.

Dr. H. M. Ami gave an account of "The Mastodon in Western Ontario," speaking particularly of the remains of three which had been found—two in Essex County, and one in Norfolk County—and describing the sedimentary formations in which they occurred.

Dr. Robert Bell, of Ottawa, read two papers—one on "Mastodon and Mammoth Remains found near Hudson Bay," and another on "Fossil-like Forms in Sault Ste. Marie Sandstone." Under the former heading he gave an account of the discovery of some mastodon bones in 1877 near the junction of the Mattagomi and Missinaibi rivers, to form the Moose river, in the southern part of the basin of Hudson Bay, and describes the superficial deposits in that region, and of the finding of a peculiarly small mammoth's tooth on Long Island off the Eastmain coast of Hudson Bay. He discussed the question of the specific identity of this small mammoth with the common species of more southern latitudes in North America. Under the second heading he stated that in the bottom of the pit which was excavated in the sandstone for the canal lock on the south side of the Sault Ste. Marie in 1891, a bed was found covered with very distinct markings, which in some respects resemble large plant remains, but they are probably casts of desiccation cracks The author's remarks will be illustrated by photographs of four large specimens.

Prof A. P. Coleman treated of "Clastic Huronian Rocks of Western Ontario, and the Relation of Huronian to Laurentian." He spoke of the rocks themselves, and of their arrangement in the region, and a few remarks on the same subject were made by Dr. Bell, who had worked geologically in that district.

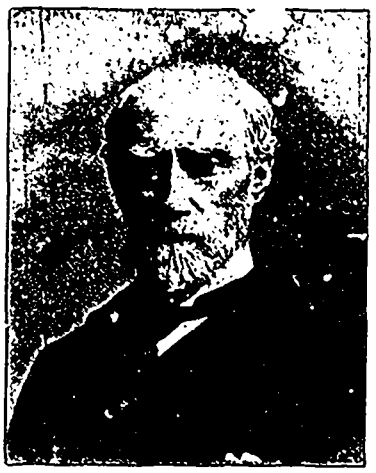
Other papers of Canadian interest were contributed by Sir Wm Dawson, R. W. Ellis—Notes on the Sands and Clays of the Ottawa Basin; Bailey Willis—Drift Phenomena of the Puget Sound Basin; Frank D Adams—Nodular Granite from Pine Lake, Ont; Nevil N Evans—Chemical composition of the Granite from Pine Lake, Ont., E. A. Barlow—On the occurrence of Corundum in North Hastings, Ont., Frank D. Adams and Jno T Nicholson—Experiments on the flow of rocks now being conducted at McGill University.

FIFTY YEARS IN TELEGRAPHY.

The Toronto Club gave a complimentary dinner on December 22nd to H. P. Dwight, president and general manager of the Great North-western Telegraph Company. The occasion was the 69th birthday of the guest of honor, and the celebration of the jubilee of his connection with the telegraph service Many of the most distinguished men in Canada were present at the banquet, and letters of regret were read from others who were not able to be present. In replying to the toast of "the guest of the evening," Mr. Dwight read a sketch of his early life and connection with the telegraph business, from which we take the following extracts:

"I was brought up," said Mr. Dwight, "on a small farm of 25 acres, near Oswego. When about eighteen years of age the erection of a telegraph line had just been completed between Oswego and Syracuse, and I made application and obtained permission to enter the Oswego office in order to learn the business of an operator. I had heard about this time that a

telegraph line was being built by the Montreal Telegraph Company in Canada, where I obtained employment on the line which had been erected during that season between Quebec and Toronto, a distance of 500 miles, on which some 12 or 15 offices were being opened. Mr. Wood, I might mention, was



H. P. DWIGHT.

the first pupil of Prof. Morse, and one of his most intimate friends. We took instruments along with us, and opened the office in Belleville the following day, where I was left in charge and where I performed the duties of both operator and messenger, and remained for a couple of months. At the end of that time I was ordered to Montreal, to take my place in that office as an operator, and remained there until the spring of 1850. While acting as operator I also acted occasionally as messenger, batteryman, line repairer, and in fact did everything more or less that was necessary to be done in connection with the business of the office. During the time I was in Montreal our staff consisted of four or five persons, O. S Wood, our superintendent; myself, as chief operator (and sometimes the only one), one or two clerks, and one messenger, a faithful old soldier who delivered messages with a good deal more reliability than speed.

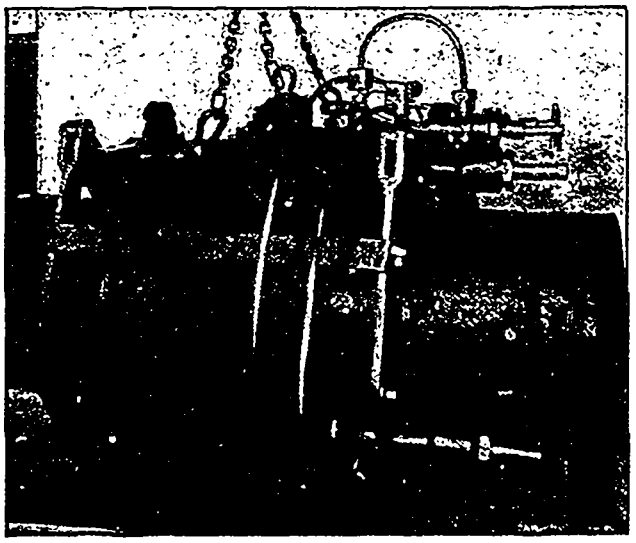
In the spring of 1850 I was sent to Toronto to take charge of the company's business here, and to be in a position to recommend such extensions in the Province of Ontario as might seem desirable. During my first year in Toronto I sent and received myself on the instruments every message which passed over the line to and from this point. I had not been long in Toronto before I began to suggest to the head office various extensions of our lines, and as these suggestions were almost invariably adopted I grew bolder and more reckless, until the head office began to get nervous and frightened. It was finally concluded, however, and I was notified by our superintendent, that I should do as I liked, it only being required that I should give notice each winter of what lines I proposed to build during the ensuing season. During the following years arrangements were made for building a line along the Great Western railway, and from time to time other railways, as they were projected and built in Ontario, such as the Port Dover & Lake Huron, the Toronto & Nipissing, the Northern, North Simcoe, Port Hope, Peterborough & Lindsay, the Midland, Grand Junction, Hamilton & Lake Erie, Hamilton & Northwestern, Lake Simcoe Junction, Welland, Whitby & Port Perry, the Victoria, the Toronto, Grey & Bruce, etc. Not only did we arrange to build lines along these different railways, most of which were afterwards consolidated with the Great Western, and the Great Western, and finally all the others with the Grand Trunk, but we also covered all the principal highways in the province. I remember well an occasion when a rather sarcastic enquiry came from the secretary of the Montreal Telegraph Company as to whether I had found any more sawmills to which I proposed to extend the lines. The policy of extension adopted, however, turned out to be a fortunate one, and to-day the map of wires covering the country looks like a thickly-woven spider's web through which a fly could scarcely escape. There is hardly a town or village of the least importance in the country which is not included in this network of lines, to say nothing of the present telephone system, so that instantaneous electrical communication is almost within the reach of every man's door.

When I commenced my career as an operator there were only two railways in the country, a short line of nine miles between Montreal and Lachine, and the other between La Prairie and St. Johns. There was not a mile of railroad in Ontario or any other part of the Dominion, and as illustrative of how one enterprise may help another, it may be said that railway traffic is enormously increased by the assistance rendered by the telegraph in facilitating the movement of trains. The tariff on messages in the early days was reckoned in Halifax currency. On any extensions of the lines a small additional rate was charged, until after a great many extensions charges ranged from 1s. 3d. to 5s. or 6s., and it became a question for careful consideration as to how the matter might be simplified. My advice was asked in the matter, and I procured statements from all the different offices showing the exact number of messages handled under the different rates. It was discovered that over 90 per cent. of the messages sent were under the lower rate, and consequently between offices the nearest to one another. I submitted a report to show that the difference between these high rates and a uniform rate of 25 cents would involve no great loss to the company, while it would appear to the public a very great concession, and recommended that the uniform rate should be adopted, which was done. The consequence was that business soon began to increase between the remoter points on the line.

Our system of telegraphs is in some respects precisely the same as when I learnt the business 50 years ago, but there have been many ingenious improvements made in the instruments, and in the use of the wires. One of these improvements is what is known as the quadruplex system—that is, the use of one wire between two terminal points—Toronto and Montreal, for instance—made to answer the purpose of four—one real wire, three phantom wires. Four operators do duty at each end of the line and work independently, precisely as if there were four separate wires. Before this method of using the wires was discovered such a thing would have seemed as impossible as it would now to make a single railroad track answer the purpose of four independent lines These electrical matters are full of wonders.

RING JOINT FOR PIPES AND TUBES.

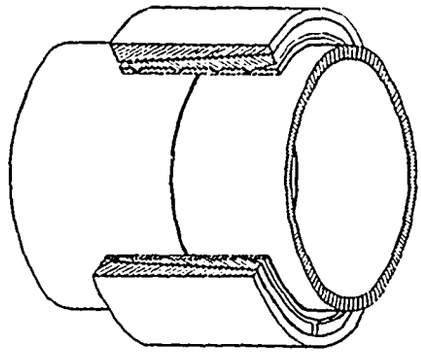
An interesting exhibition of a new method of joining iron pipes was recently given at John McDougall's Caledonia Iron Works, Montreal. It is known as the Ring Joint method, and the necessary parts are a strip of cold sheet lead, a wedge ring, made from a bar of iron or steel, ridged along its interior length, sheared to size and bent into a ring with open ends, and a compression ring, which is a rigid collar of wrought iron or steel on a plain casting, having its inner surface tapered to the form of the wedge.



The application of this joint is simple in the extreme. The strip of sheet lead is placed around the pipe with its ends slightly overlapping, over this is placed the wedge ring and the rigid compression ring is lightly fitted over the whole. The pipes are then carefully adjusted and the series of rings placed over the joint. By the application of mechanical or hydraulic pressure the compression and wedge rings are forced closely together. The wedge ring, being open, is powerfully contracted by the collar and thrusts its ridges into the

sheet lead, contracting it at the same time, thus producing a contact which approaches positive amalgamation

This joint can be used on any kind of pipes cast iron, welded or riveted iron and steel pipes, or on rolled longitudinally seamed pipes, such as Williams' patent No bell sockets or specially formed ends are necessary, and cut pipes may be used. There is no waste of lead, and, since it is quite cold, no injury need result to the composition on coated pipes The joint can be quickly removed by a few smart taps with a hammer on the compression ring, and without any damage or loss of material.

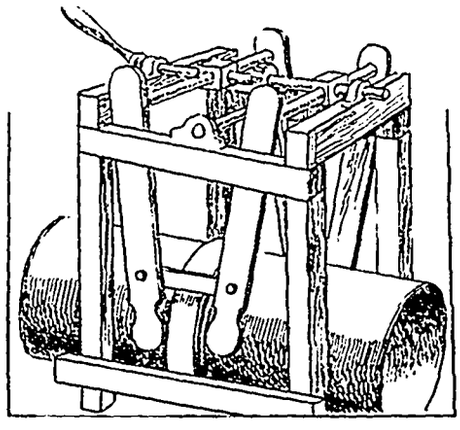


RING JOINT SHOWING METHOD OF APPLICATION.

The joint may be employed in dry or wet trenches, or under water, and is applicable to all diameters ranging from ordinary gas tubing up to the largest street mains, and is suitable for all work for which cast iron pipes are used in conveying gases, vapors and fluids

For closing the joint on pipes and tubes of small diameter, the machine employed is a combination of tongs operated by hand screws Pipes of large diameter are joined by means of a machine consisting of three small hydraulic presses operated by a hand pump. These tools are easily portable and can be carried along the pipe track by hand, or suitably mounted on a hand cart.

During the exhibition two iron pipes of about 18 inches diameter with plain ends were joined by this method and subjected to a water pressure of 400 feet with perfect success The inventor is D. J. Russell Duncan, of Victoria St., London, who was in Canada recently and is already known to our readers, and the sole agents for Canada are J. W. Pyke & Co., of 35 St. Francois Xavier St , Montreal.



A number of well known engineers and manufacturers who witnessed the experiment, expressed their confidence in the success of the process, and it is the intention of Messrs. Pyke & Co. to put the new process on the Canadian market by either leasing the machines on royalty to users or selling the rights to manufacture the machine. They are open to negotiate with responsible parties to this end.

LITERARY NOTICES.

The National Brick Manufacturers' Association of the United Sta es appointed a commission in February, 1895, to make such tests of paving brick as could be used as standards. This commission has now reported in a pamphlet of 110 pages, containing 34 tables of tests and a large number of diagrams, of great importance to every engineer who has to deal with the brick-paving problem. These tests and calculations are issued as being thoroughly reliable, the committee having in view especially the establishment of standard tests that would prove ample for municipal authorities

Those who have read the book "In the Days of the Canada Company," by the Misses Robina and Kathleen M. Lizars, will be keen to read any fresh contributions from the same source, and when a new book was announced the other day dealing with the rebellion times in Canada, there were confident anticipations of a good treat. The book has appeared and our anticipations have been realized. "The Humors of '37," is not an ill-chosen title as might at first sight appear, for taking the word humor in a broad sense we have in this a judicious and appetizing mixture of "the grave, the gay, and the grim" We should expect in a book on this subject plenty of the grave and grim, but we do not always associate gaiety with treason, though fun is often tumultuous In this work of 369 pages, the reader will, however, find instruction and amusement combined with a tact and instinct possessed by few writers To the old, the "Humors of '37" will recall many a scene of those exciting days, while to the young it will give much solid information in an entertaining garb relating to a great crisis in Canadian history The book is published by Wm Briggs, Toronto, and like all the recent publications from this house is excellently printed.

Undoubtedly the book of the year on South Africa is that written by Poultney Bigelow, at the request of Harper Bros., New York, by whom it is published. It was fortunate for the author that he had written his other interesting book, the "History of the German Struggle for Liberty," before his visit to South Africa, instead of after, for he had thus opportunities of comparing German official methods with British methods in relation to the Dark Continent, and while he writes with an American's prejudice in favor of the republican form of government, and is most enthusiastic in his admiration of President Steyn, of the Orange Free State, and Paul Kruger, of the Transvaal —to the former he dedicates the book—he gives enough light on German and Hollander official character to show the Boers what their fate would be if they fell under control of those countries. Our author admits that the surrender of the Transvaal to the Boers in 1881, though magnanimous, was a mistake. "The Boer Government to day is applying to a complex modern community administrative principles fit only for a community of cattle herders and teamsters." The recent agitation which led to the Jameson raid "was not an English rebellion against Dutch domination, but a union of Americans, Afrikanders, English—in short every white man who was not an official of the Boer Government, was heartily in favor of a reform in the Government" The Boers confessed their incapacity for governing a modern State by enacting that revenue was to be raised by selling monopolies. "The political economy of Spain in the days of Philip II. was applied by Paul Kruger of 1896 to a community of the most modern and progressive manufacturers ever assembled together in one spot."

The convention number of the *Street Railway Journal*, of New York, is a splendid monument of enterprise in American trade journalism. This number contains 361 pages, of which 133 pages are reading matter The advertising pages are quite as interesting as much of the reading matter, and large sums of money must have been spent by various manufacturers on designs for their advertisements. Each copy of the paper weighed 4 lbs , and the postage abroad was 32 cents for a single number.

"Across the Sub-Arctics of Canada" is the title of a very important contribution to our scanty knowledge of our great northern regions about Hudson Bay, by J. W Tyrrell, C E , of Hamilton, brother of J. B Tyrrell, of the Geological Survey It is an instructive account of a journey of 3,200 miles by canoe and snowshoe through the "Barren Lands" to the west of Hudson Bay, undertaken by the author and his brother in 1893. The expedition left the railway at Edmonton, N.W.T., and descending the Athabasca River to Athabasca Lake took its way by the chain of lakes and rivers to Chesterfield Inlet, thence coasting along Hudson Bay to Fort Churchill and York Factory, and from there through the forest down to Lake Winnipeg, and home *via* Winnipeg. Mr. Tyrrell treats of the customs and habits of the Indians and Eskimos met with, the game, fish and economic animals, the timber, minerals, etc , and gives much information on the geography, botany, geology and general natural features of the country traversed. Maps and numerous illustrations add interest to the work, which makes 280 pages, and a valuable appendix gives a catalogue of plants collected on the trip, while another appendix contains a vocabulary of Eskimo words and phrases. We hope to give a more extended notice of this book, and meantime commend it to all who would learn more of our great heritage in the north Published by Wm. Briggs, Richmond street west, Toronto.

The December issue of *Power*, New York, is an international number, and its table of contents is printed in German, Spanish, French, and English The leading article is a description of the proposed power station for the Metropolitan Street Railway Co , New York

"Power Catechism," being correct answers to direct questions covering the main principles of steam engineering and the transmission of power, has just been issued by the publishers of our able contemporary, *Power*, of New York. There are 735 questions answered, followed by tables from which various calculations can be made by the steam engineer, the whole making 226 pages, illustrated by numerous diagrams. Price $2.

Those interested in bicycles who wish to study the theory of what constitutes a perfect bicycle bearing should get the new catalogue issued by the Canadian Typograph Company, Windsor, Ont., manufacturers of the celebrated "E. & D." bicycle. The illustrations are very clear, and the catalogue is worth studying for its lucid explanations of the mechanical points of the bearing.

E Leonard & Sons, engine and boiler manufacturers, London, Ont., have just issued a new catalogue (No. 30), containing 44 pages of matter showing some of their best types of engines and boilers. This Company manufacture the Leonard-Ball automatic cross compound engine, and Leonard-Ball tandem compound automatic engine, and simple automatic engine. They also manufacture the Leonard-Tangye engine, which is made in sizes from 50 to 200 h.p., and the Leonard-Clipper engine, which is a new type made in 7 sizes from 15 to 50 h.p. The catalogue gives a bird's eye view of the large works of the Company, and a few interesting facts of the history of the firm, which began business as far back as 1834, its London history dating from 1838. The catalogue will be mailed to anyone interested.

The Industrial Publication Co. of New York, have issued the first number of a series of handy books on mechanical subjects. The first issue treats of elementary principles of machine design as applied to steam engines, and is edited by J. G. A. Meyer, author of "Modern Locomotive Construction." It contains 92 pages and has a number of very clear diagrams and illustrations. The price is only 25 cents.

"The Year Book of the Society of Engineers of the University of Minnesota," at Minneapolis, makes a large pamphlet of 140 pages, and contains papers on nineteen different topics, some of which are very well treated.

The W. J Johnston Co., 253 Broadway, New York, are to be congratulated on the enterprise shown in the compilation of their "Electrical and Street Railway Directory" of the United States and Canada It is the only work of its kind in America, and gives a list of all the central lighting stations, electric, horse and cable street railways, telegraph companies, district messenger companies, telephone companies, mining plants and as full a list of the isolated electric plants as one could expect to find. It also contains a list of manufacturers of and dealers in electrical and street railway apparatus and electrical supplies In each department it gives a number of particulars showing the capacity of the plant, the capital employed, the officers of the company and other information bespeaking great care and labor in the compilation. The issue of 1897 makes a volume of 752 pages, and is substantially bound in cloth. Price, $5.

The American Machinist Publishing Co. has issued a neat linen covered volume of some hundred pages, "American and Other Machinery Abroad," which gives in an interesting way the history of the United States trade in Europe in machinery, and a host of facts as to its present position, as well as data upon which a prediction of the future may be founded.

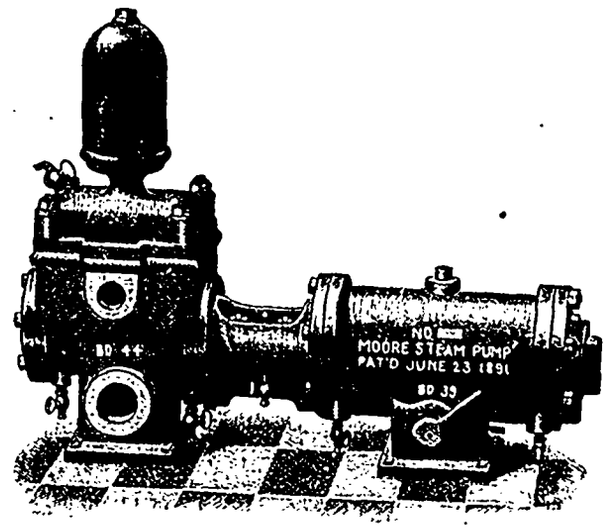
CALENDARS.

THE CANADIAN ENGINEER acknowledges with thanks the receipt of calendars from Morton, Phillips & Co., mfg. stationers; D. K. McLaren, agent for belting and mill supplies, 24 Victoria street; the Queen Insurance Co., the Alliance Assurance Co., the Insurance Co. of North America, the Northern Assurance Co., all of Montreal. The Conger Coal Co (Toronto) calendar is one of the most up-to-date which we have seen The view of Dawson City which adorns it is a very cooling sight indeed, as well as an artistic decoration. The Packard Electric Company, St. Catharines, Ont., wishes its friends a happy new year on its monthly blotting pad for January. A. B. Jardine & Co., Hespeler, Ont., have sent out a neat calendar, showing a picture of the village blacksmith, whose opinion is that "it pays to use the best tools." The B. Greening Wire Co., Hamilton, have repeated their famous historical calendar of last year, which shows the three generations of the proprietors, and a fine view of the Hamilton, Ont., works

THE MOORE STEAM AND VACUUM PUMPS.

The steam valve is placed on the body part of the piston, within the steam cylinder, with heads provided with suitable metal packing rings. Within the body of the piston are the steam ports, leading to each end of the cylinder, and registering alternately with the annular grooves or the valves in its actuation. The longitudinal sliding motion of the valve on its seat, is limited between the piston heads. The valve being carried on its reciprocation by the piston, until its head passes the steam inlet port in centre of steam cylinder, thus admitting steam between the valve head and piston head and forcing the valve against the opposite piston head; changing the relation between the annular grooves in the valve and steam ports in the piston, causing a reverse motion of the piston, and exhausting its steam into the centre of the piston, thence through the hollow piston rod into exhaust chamber between the stuffing boxes By reason of the two steam ports in the valve seat being of different areas, the piston recedes gradually for a moment and then completes its stroke.

Its simplicity of construction, its small number of parts, its large wearing surface for the valve, together with its positive value motion, with no possible chance of its becoming balanced on its centre, through leakage or other causes, make it, the makers claim, the most desirable pump on the market.



By the method used in restricting the exhaust steam with the slow start and steam cushion for the piston, the speed of the pump is automatically regulated. Never running too fast to take suction, or fast enough to injure its working parts should the water supply give out, it can be regulated to supply water in the boiler to a uniform height without attention.

As it will work with a lower steam pressure than an injector, or most steam pumps, the boiler can be filled after stopping the engine, without an extra fire. As a boiler feeder this pump has no equal. It is made to couple on either right or left. With the working parts entirely closed, it can be set up in the most convenient place without fear of any damage from grit or dust. The stuffing boxes being enclosed in the exhaust chamber, there is no drip or escaping steam into the room, and by means of the lever on the front side of the pump, the exhaust steam and all drippings from the stuffing boxes can be thrown into the suction chamber to warm the water, and is then returned to the boiler.

This pump, the maker believes, avoids the sensitive qualities found in other pumps for similar purposes. Starts promptly and will clear itself. No skilled engineer necessary to operate it. This pump heats water to a degree of temperature higher than any other pump on the market. These pumps are built by an old established and responsible firm, and are guaranteed to be perfect in material and workmanship. They have had thorough and practical tests by experienced engineers, who unite in speaking in the highest terms of it. Darling Brothers, Reliance Works, Montreal, are the Canadian agents of the Moore Steam Pump.

ARC LAMPS FOR CONSTANT POTENTIAL.

The Canadian General Electric Co., Limited, announces that it is prepared to furnish a satisfactory and economical arc lamp for constant potential, alternating current circuits. The problem has been a difficult one to solve, but the results obtained have, the company claims, warranted any apparent delay.

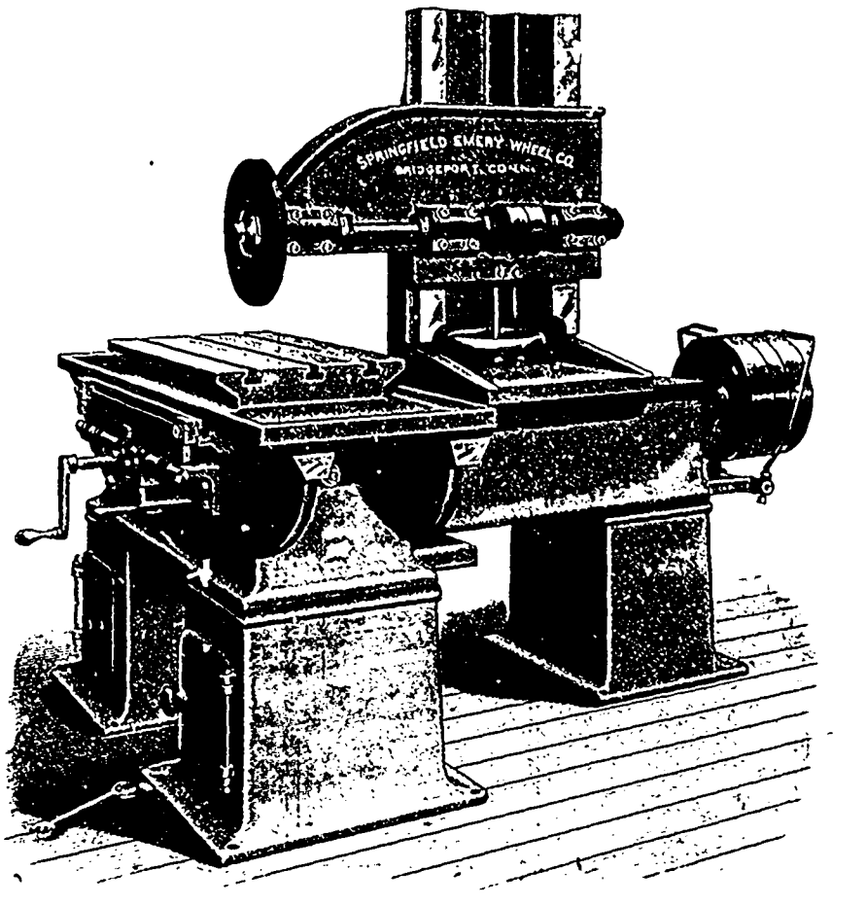
The principal features of the new lamp are briefly as follows: Small maintenance account, by reason of a life of 60 to 70 hours, with one pair of carbons. The lamp is simple in construction, has few moving parts and operates quietly. Great economy. Ninety-three per cent. of the energy is utilized in the arc. Operates independently on circuits of 100 to 120 volts, and frequencies of 60 or 125 cycles. The lamp requires 70 volts potential at the arc, and consumes 6 amperes. The difference in the potential at the arc and at the terminals is taken up by an inductive resistance, which is the unique feature of the lamp. This inductive coil does not consume in excess of 25 watts, and is placed within the interior of the ornamentation. The use of high grade carbons is essential.

The lamp is artistic in appearance and especially suitable for interior illumination. The ornamentation is finished in ground brass and black enamel.

OPEN SIDE SURFACE GRINDER.

The accompanying cut represents a 2 ft. open-side surface grinder, a practical machine for surfacing flat surfaces up to 16 inches in width and 24 inches long, and will admit work 12 inches in under the emery wheel. The machine is fully automatic, the carriage is driven by a screw connected by bevel gears to the main shaft of the machine. The emery wheel head, to which the automatic feed is attached, is also driven by a screw, the end of which is shown with a crank attached on the front of the machine, which can be operated by hand or automatically as desired. These machines are made to take in work of different lengths from 24 inches to 144 inches

For further particulars address the Springfield Manufacturing Co, Bridgeport, Conn., which also manufactures a large line of different varieties of surface grinders



OPEN SIDE SURFACE GRINDER.

PLUMBING.

Editor THE CANADIAN ENGINEER

SIR,—I have read with pleasure the letter on sewage ventilation on page 238 of December number, and the three able articles on the disposal of sewage and sewage ventilation in your issues of April, September and November, and can bear out the remarks of "Constant Reader" by relating facts that have come to my notice, proving that the sanitary by-laws at present in force in Toronto, are made and enforced for the benefit of the officials more than to improve the public health

At No. 243 Church st there is a blacksmith's shoeing shop. At the rear end, on the line of Dalhousie st., stood an old dwelling house with a Philadelphia Hopper Water Closet This house was pulled down to give yard room and more light, and an outside pit closet was built in yard with all new standard material, and the old closet and pipes were discarded. The position of the new w.c was four yards northwest of the former position, but on the line of the same drain pipe, which had to be cut and shortened and one full W. Y. junction, one bend and one length of pipe connected to it to receive the soil and rain water pipes. This old 6-inch drain continued from the yard under the smith forge to Church st, about 70 feet, and connected with the street drain very properly, without the catch bag or running trap, as it is called, and stink pipe usually termed the breather The inspector demanded that the drain should be broken at the Church street line, and a trap and breather put in, which was done at a cost of about $15, the depth being nearly 13 feet. When he came to inspect, he found the work had been completed in a first-class, workmanlike manner, but his pocket level showed that the drain fell slightly the wrong way just at this point, but on digging down at rear end of shop, it proved that in the 70 feet length of smith's shop the drain rose four feet, or if a regular grade was given, it would be over ¾ inch to the foot, and as only three lengths of pipe was bared, it did not prove anything, because a sensible drain layer will keep the drain down at the delivery end, and rise at beginning end to give the flow a good start However, the inspector ordered that the old drain should be bared, which he himself could see could not be done without removing the smiths' fires, bellows and anvils, lifting floor and digging at a 12 ft depth.

It was rather remarkable that the diggers' pocket level showed the three pipes to be about level, with an inclination of fall towards the street; so also did a carpenter's level, and it puzzled a few why the inspector's level showed the fall to the contrary way

The owner of the property saw that he could not easily please the man with unlimited powers, so he paid the city nearly $14 to put in a drain from Dalhousie street, and from the street line to pit w.c in yard, put in a heavy cast iron drain pipe with local joints.

The weather at the time was at or below zero, and the embankment of drain very dangerous, and the pipe-fitter made a written application for inspection and smoke test under the clause, which relates "That when soil is dangerous the inspection shall be made forthwith, and when the water test is not safe by reason of frost such test shall not be used." See by-law XI, page 11.

After waiting four hours a boy was sent to see when the inspector would please to come, returned with the order to fill the frozen pipes with water, and he would come and see them This meant having them filled with ice and the destruction of the rubber plugs and iron traps that could not have been again emptied, before they became solid.

These facts prove that an unnecessary expense of about $100.00 and a troublesome delay and annoyance of several weeks, was given by this city official and by-laws, to secure an outside privy to accommodate five working smiths, though every foot of drain under the smithy floor, was, where seen, first-class in material and workmanship, and covered with about seven feet water-tight stiff clay, that would not let sewer gas penetrate

Query: Is it the public or the public servants that secure the advantages of the public health by-laws in this case Let us cite a case to show a contrast:

There are three houses in the West End, that are drained on the rule of thumb principle without proper judgment. Some months since, the agent for owners asked a plumber if he would put water closets in each house at a very low price, which he named. The plumber replied that he could not, because the drains were not right and would be condemned by the inspector, and the money offered would barely cover cost of plumbing material required, and labor, and the cost of $10 in which the waiting for inspector to come, and getting the work passed was not included This agent showed that he had a pull, and that no inspector or official would interfere, and he undertook to secure the plumber from any blame or expense on that account, if he, the plumber, would do the job at his price The bargain was closed, the water closets put in, the old rotten drains patched up the easiest way to make them take the stuff, and everything done openly without interference from any city official, though the inspector did visit his friend while the work was going on, in the evening, and looked through the work.

This sort of city officialism is common enough, and openly enough done, but the council will not notice it, except the parties pinched have another pull with them Respectfully yours,

H. L. MCKINSTRY.

150 Victoria St.,
Toronto, Dec. 27th, 1897.

APPLICATION for a charter is made to the Ontario Legislature for the Smith's Falls Rideau & Southern Electric Railway Company to construct electric railways, the principal lines being within Smith's Falls, with extensions to Lombardy, Oliver's Ferry, Portland, and to Rideau Lake, Harlem, Chantry, Frankville, Toledo, Newbliss, Merrickville, Burritt's Rapids, Oxford Mills, Bishop's Mills, Easton's Corners, Irish Creek and other points within the said counties of Lanark, Leeds, and Grenville.

TO SEE IT IS TO APPRECIATE IT.

MIKADO GOLD MINING CO., LIMITED, HEAD OFFICES, LONDON, ENG.

BIGGAR, SAMUEL & CO., MONTREAL:

DEAR SIRS,—I have just been handed a copy of your worthy paper, THE CANADIAN ENGINEER, and finding it so full of bright and useful reading, I have concluded to subscribe for it at once So you will please find one dollar enclosed for same.

I remain, yours truly,

GEORGE W McKENZIE

Rat Portage, Ont., December 17, 1897.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The twelfth annual meeting of this society is to be held on Tuesday, 11th inst According to present arrangements, the meeting will be called to order at 9 30 a m., on Tuesday, under the presidency of T C. Keefer, C M G After reading the minutes, the scrutineers will be appointed for the election of officers. Through the courtesy of the C P R. and the G.T R. a special train will start at 11 o'clock for Chambly, to enable the civil engineers to view the works of the Royal Electric Co. at that place, and afterwards to enjoy an entertainment at the hands of the Electric Co On Wednesday, at 10 o'clock a m., the society will receive the reports of the outgoing council and address themselves to the transaction of general business.

HENRY HOLGATE, C.E.

The prominence that is now being achieved by Canadian electricians has received another exemplification in the selection of Henry Holgate, C E., of Montreal, as manager of the new West India Electric Co., of

HENRY HOLGATE, C.E.

Jamaica. Mr Holgate will go to Kingston, Jamaica, about the first of February, where he will superintend the erection of about 25 miles of railway, which will probably be extended later on. Henry Holgate was born in Milton, Ont., in 1863, and served his apprenticeship with the Northern Railway of Canada. He became chief engineer of the combined Northern and North-Western Railways, which were merged into the Grand Trunk in Feb., 1888 He continued as chief engineer of this division under the Grand Trunk till 1892, when he took charge of the Central Bridge and Engineering Co., of Peterboro, as engineer for a year, during which the steel work of the new Union Station at Toronto was constructed. He came to Montreal in June, 1894, as engineer for the Royal Electric Co., and built and equipped the new factory The directors of the Royal Electric Co being interested in the Montreal Park and Island Railway, he was transferred to the latter company in June, 1895, where he remained in charge of operation and construction to the present time We hope the readers of THE CANADIAN ENGINEER may hear from Mr Holgate in his new field of operations.

ELEVATORS: ELECTRIC VS. HYDRAULIC.

Editor CANADIAN ENGINEER

SIR,—I trust you will allow me to reply to the discussion by Mr. Philip, in the December issue of THE CANADIAN ENGINEER, of the comparative merits of electric and hydraulic elevators for the city hall of Toronto. It would seem probable that Mr. Phillip has more knowledge of the operation of hydraulic than he has of electric elevators. The comparisons and statements made by him are open to serious question, and as his opinions may have weight with the readers of your valuable paper, I will state briefly my reasons for disagreeing with some of his conclusions. His divisions of first cost, safety, reliability, economy and cost of maintenance will be followed.

Cost.—The first cost of the electric elevator plant was $30,000, and the cost of an extra high speed engine, dynamo, incidental apparatus and piping to run such elevator would be less than $5,000—total cost of $35,000, or $10,500 less than the bid of the lowest hydraulic elevator company. If the lighting engines were merely enlarged to meet the wants of the elevators, the difference will be still larger.

Safety —Again I must take exception to Mr. Philip's statements. The electric elevator is safer than the hydraulic; in addition to the mechanical safety devices of the latter, there are independent electric safety appliances, which not only prevent actual drop, but prohibit unsafe increase in speed. Of still greater importance is the condition that the tendency of the electric machine is toward safety, that is, leaks, short circuits or trouble of any kind tends to remove power and prevent motion, while in the hydraulic elevator the tendency is exactly opposite, a leak or a break meaning movement in one direction or the other This is clearly shown in the familiar "creeping" of the hydraulic elevator due to air in the cylinders or leaks of one kind or another; yearly there are several deaths due to this cause

Neither is there an elaborate "cycle of changes" in applying power Current is applied to a solenoid, causing a switch to close the motor circuit, and gradually cut out resistance to the current flow. To stop the car, the auxiliary current is cut off by releasing a push button and all switches open, the car then stops, due to the nature of the worm gear, and in some cases to the use of an auxiliary brake thrown on mechanically, or by closing the motor circuit on itself, causing the car to do work and slow up. Hence there is no power "used to stop the car as well as to start and run it."

Reliability —The machinery of an electric elevator does not appear complicated—it is in use in hundreds of New York buildings and receives the least possible care and attention; it is practically the simplest method of hoisting a weight, similar in some respects to the hod hoists, and consists of a drum around which the hoisting and counterweight ropes wind, the drum being driven by worm gear and electric motor. The comparative wear and tear of the two types is yet to be determined. So far electric elevators have not shown signs of wearing out, but taking the generating machinery into consideration, their life is probably less than that of hydraulic pump and cylinder. The difference is not of great moment.

Economy.—Here I must absolutely contradict Mr. Philip. His contention that a plant of underbalanced hydraulic elevators is more economical than a plant of overbalanced electric elevators is totally at variance with both theory and practice. He states that the pump does an average amount of work continually. This is not quite true, as the size of the pressure tank for such a condition must be abnormal, but for purposes of discussion it may be taken as a fact. But even so, the "average" work done is not the "average" work of the electric elevator plant. In the first case, as the work is the same irrespective of the load lifted, it is the average of the maximum capacities of the elevators plus one-third of the weight of the unloaded cars. In the second case the work done is merely that due to lifting the difference between the actual live load and the average load, and this is reduced by the return of current to the source of supply by the descending elevators Figures taken from about twenty elevator plants of this type in New York city show from 1.7 to 2 5 kilowatt hours per car mile, with speeds varying from 250 to 400 feet per minute, capacities from 1,500 to 3,000 pounds and cars from 20 to 30 square feet area. The coal per kilowatt hour in one of these buildings was from 4 pounds in summer to 5½ pounds in winter, using simple Corliss engines direct connected to electric generators, while another building with high speed simple engines and long lines of piping required from 8 to 9 pounds. The car miles per day varied from 10 to 22, depending on the speed. Taking an average of 16 miles and 2.1-k.w. hours per car mile, the coal per car per day, in an electric plant where light is also supplied, is from 135 to 300 pounds, depending on the type of engine and heating conditions. Two hydraulic elevators operated by compound pumps, under the best conditions, in a fire insurance building in New York, use 1,000 pounds of coal per day, while with a simple pump in the same building they used 1,500 or from 500 to 750 pounds per car per day. Where expensive high duty pumps are employed the test of the American Tract Society elevators by Charles E. Emery, Ph.D., shows the coal per mile to be over 28.8 pounds, or 461 pounds for 16 car miles under test conditions. These cars were built for high speed and are not of course to be compared with the elevators in question, but it is safe to say that electric overbalanced worm-gear elevators will not and do not use over three-fifths the coal per car mile in ordinary conditions, that would be and is required for hydraulic operation, and the proportion will generally be less.

It is not necessary to have a plant of rated capacity equal to that of all the elevator motors, though Mr. Philip appears so to believe. Its rated capacity need not be more than is required for starting two elevators and running the other two (if there are four installed), as all engines and generators are built now-a-days with an excess momentary

capacity of from 50 to 100 per cent. Nor is there any short circuit of the motor on starting—as in all types of electric elevators variable resistance is inserted at starting between the generator and motor. I am sorry not to be able to coincide in my views as to storage batteries with those expressed by Mr. Philip. They seem to me to have decidedly passed the experimental stage and have become a recognized part of the modern building plant installation where economy is obtainable by their use Whether they would be advisable for the city hall is quite another question.

It may be of interest also to state that the Edison Illuminating Company of New York does not consider "electric elevators a curse to a lighting station" They have installed one in their building as an object lesson and advocate their use as much as possible.

In conclusion I am glad to be able to agree with Mr. Philip as to the advisability of installing an isolated plant In general, with a building as large as the city hall, a private plant will prove highly economical provided it is managed as it would be by a private corporation.

Very truly yours,

PERCIVAL ROBERT MOSES,
Consulting Electrical Engineer.

35 Nassau St., New York,
December 27th, 1897.

STEEL RAIL HIGHWAY PROPOSED BY THE U. S. DEPARTMENT OF AGRICULTURE.

Complete designs for wagon roads, with steel trackways, have been prepared by Gen. Roy Stone, Director Office of Road Inquiry, U. S. Department of Agriculture. As many of our readers know

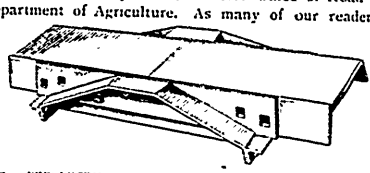


FIG. 2.—PERSPECTIVE VIEW OF RAIL JOINT FOR STEEL RAIL HIGHWAY

says the *Engineering News*, the Agricultural Department has given much attention to the subject of good roads and has organized the office of Road Inquiry to foster highway improvement and experiment with different systems of country road construction. Through the efforts of this office a model macadam road has been built at New Brunswick, N.J., and a combination macadam and dirt road, 7,000 feet long, at Geneva, N Y The road at Geneva has a centre of macadam 8 feet wide, with rolled dirt roadways on each side These samples of road construction are designed to be object lessons in the economy of good material and construction for country roads

The possible advantages of combining a steel trackway for wagons with the broken stone centre, has led the Office of Road Inquiry to investigate the subject with the idea of building an experimental road of this kind. This study has resulted in the design of the steel rail highway which is illustrated in the accompanying cuts Fig. 1 is a cross-section of the completed road, showing the arrangement of the steel rails and stone filling, and the nature of the drainage system. Fig 2 is a perspective view of the rail joints, and Fig 3 is a transverse section of the same joint.

the joint are firmly bolted together, as shown by the drawings. The object of the remounting device is, of course, to enable heavy wagons, which have left the rails, to be easily returned to the track by mounting the inclined shoulder at the rail joints.

Arrangements have been made with the Cambria Iron Co., of Johnstown, Pa., to roll these track rails, the arrangement to go into effect as soon as definite orders for an aggregate of one mile of road are obtained. It is estimated that the cost of rails and joints for one mile of road in the United States will be $3,500 As indicating the possible utility of steel rail highways, Mr. Stone has obtained information regarding two previous experiments with steel rails on wagon roads, and has furnished us copies of the letters from the builders, which describe the construction and operation. The first letter is from F. Melber, engineer and contractor, Standard Building, Pittsburg, Pa., and is, in substance, as follows:

"My road has been in position for about a month, and, among other interesting things, I watched the temperature of the steel when exposed to the hot afternoon sun. Every steel worker knows that steel bars lying in the yard of a bridge works, for instance, will get so warm in a few minutes that the men cannot hold them in their hands. I find that my steel stringers remain cooler than the adjacent broken stone. This, I think, is a remarkable as well as an important fact, and it goes to show that there takes place an interchange of the temperature between the inner substances and the steel, and that in this class of steel highways we do not need to provide for expansion. Altogether, I find the steel road to verify all I have said about it, even as to cost, and with regard to traction advantages I am now able to give figures. I have made twenty trials, using a gauged spring balance, and find that the average force needed to pull the iron wagon, weighing 1,550 lbs., with a 16-foot wagon-bed, is 2.5 lbs., which, reduced to a load of 2,000 lbs., means a traction force of 3 23 lbs. per ton."

The second letter is from Abel Bliss, of New Lennox, Ill., and is as follows.

"I take the liberty of giving you my experience with a steel roadway which I placed in the public highway near my home, four miles east of Jolliet, Ill It was put down April 2, 1896, on a dirt road

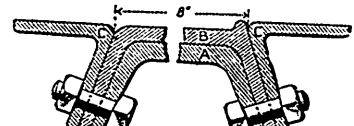


FIG. 3.—TRANSVERSE SECTION OF RAIL JOINT FOR STEEL RAIL HIGHWAY.

of typical Illinois soil, and consisted of a steel rail ¼ in. thick and 8 ins. wide, with a flange 3 ins wide turned down on either side and a ¾-in. flange turned up on the outer edge to keep the wheels on the rails These rails were let into the ground so that the flat part rested on the earth, and were fastened together at the ends by fish plates, which are so constructed as to run the wheels onto the rails after passing a team. The earth between the rails was removed to a depth of four inches, and the space filled with gravel for a tread for the horses. These

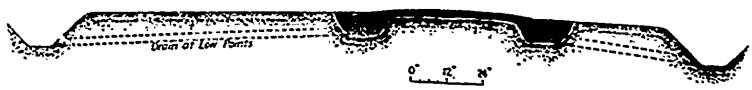


FIG. 1.—CROSS-SECTION OF STEEL RAIL HIGHWAY, DESIGNED BY THE OFFICE OF ROAD INQUIRY, U. S. DEPARTMENT OF AGRICULTURE

As will be seen from the illustrations, the general idea is to lay two parallel lines of steel rails, supported by a broken stone filling These rails have an inverted trough section, the top of which forms the track for the wheel, and is 8 inches wide, with a slightly raised bend on the inside edge to guide the wheel The thickness of the top of the section which forms the track is about 7-16 inch, and the total weight of the steel and connections is about 100 tons per mile of single track. The rails will be connected transversely at intervals to prevent spreading, but there will be no cross ties, the broken stone ballast alone supporting the rail

The construction at the joints is shown by Figs 2 and 3 An inverted trough, Section A, forms the basis of the joint support. Over this trough are slipped the two ends of the track rails, B B, which meet in a butt joint at the centre. To each side of the track rails are attached the remounting devices, C C, connected at the ends by the transverse angles, D D These three principal parts which make up

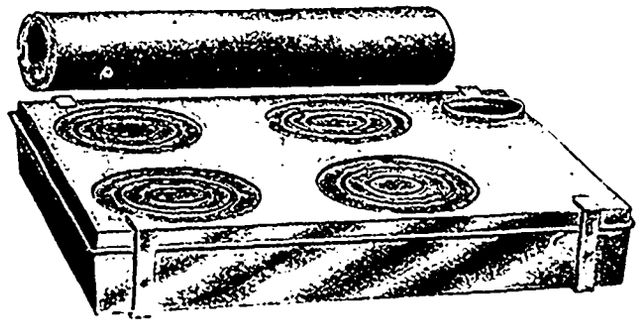
roads have been tested with all kinds of loads, including traction engines, and have retained their position very well. While the mud made the roads almost impassable here during the winter, a team could have trotted on this roadway any day with a two-ton load. About 50 tons of steel per mile will be required, having the rails ¼ in. thick, which I think is ample."

These experiments are of much interest to Canadians, especially in the neighborhood of large cities where the vehicle traffic is heavy. The added profits which every farmer would make on his produce with such roads as this would be a material factor in the development of the country.

INCORPORATION has been granted to H. S. Griffin, M.D., T. J. Stewart, W. Trusdale, Hamilton, Ont.; J. Dickenson, Glanford, and W. M. German, Welland, Ont., as the Odorless Crematory Closet and General Heating Company of Hamilton, Limited, to manufacture, sell and deal in odorless crematory closets and heating furnaces. Capital, $24,000.

TESLIN STOVES.

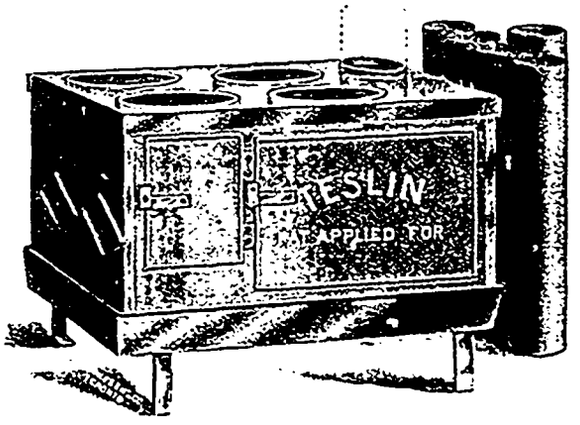
The peculiar conditions of life in the golden north are rapidly bringing into being a number of entirely new appearances to fill new wants, and also old appliances so changed as to be hardly recognizable The peaceful blanket of our more genial climate has become the fur-lined sleeping bag of the Klondyke, and the kitchen range of the south east built into the chimney and occupying yards of space has become in the far North-West the Teslin stove, which when closed up for car-



STOVE FOLDED UP

riage occupies a space of 25x2.x4 inches, and weighs with 9 feet of pipe only 53 lbs. The following are the dimensions of the Teslin stove when set up —Size of top, 28x22 inches, height, 13 inches size of oven, 22x14x9 inches, size of fire-box, 22x9x13 inches; size of fire door, 6x8 inches; size of pipe collar, 5 inches, weight with pipe, 53 pounds.

The method of setting up the stove is simplicity itself. The shipping bands become feet, and by a few easy movements, much as a



cardboard box is opened for use, this stove is set up. An illustrated card giving full instruction of the process of setting up the stove is supplied to purchasers.

This stove has direct as well as indirect draft, and the arrangement of flues direct the heat around the oven for baking as in a high-priced cook stove The simple construction of the stove renders it perfectly rigid when put together, and the heavy angled corners assist in preventing the stove from warping

Has four 8¼ inch pot holes on top.

Five lengths of telescopic pipe (supplied with each stove) will extend to 9½ feet. Also supplied with thimble for tent through which pipe passes

These stoves are being placed on the market by the McClary Mfg. Co., London, Ont

The McClary Mfg Co is making a specially praiseworthy effort to meet the demands of trade created by the opening up of the northern country, and is issuing a special catalogue giving details o goods adapted to the gold country

FIRES OF THE MONTH.

Nov 4th—Macpherson & Co.'s Foundry, Fingal, Ont Well insured.——Nov 5th—Sydney Cheese Factory, J R. Bower, Belleville, Ont., manager. Loss on building, $1,000. To be rebuilt at once.——Nov. 11th—J L. Pollock's saw mill and electric light plant, Drayton, Ont ——Dec 2nd —American Tire Co., King Street, Toronto, Loss, $6,000.——Dec 17th—Tate & Bateson's planing mill, Bracebridge, Ont Loss, $2,000, no insurance ——Dec 31st.—Kingston General Hospital, Walker's wing Damage, $10 000.——Jan 5th.—Ottawa University, east wing. Loss, $50,000.——George W Reed & Sons, manufacturers of sheet iron and roofing materials, Montreal, three store sheds Loss, $12,000, cause unknown ——Lancaster Machine Works, Lancaster, Ont., shops partly destroyed on 1st January. Loss about $1,000, no insurance; will rebuild at once.

METAL IMPORTS FROM GREAT BRITAIN.

The following are the sterling values of the metal imports from Great Britain during November, 1896, 1897, and the eleven months to November, 1896-1897.

	Month of Nov.,		Eleven months ending Nov.,	
	1896	1897.	1896.	1897.
Hardware and cutlery	£5,734	£5,224	£58,897	£03,817
Pig iron	1,732	2 724	27,936	9 209
Bar, etc	1,190	751	15,239	8,629
Railroad	2,525	11	174,434	45,789
Hoops, sheets, etc	4,044	6,562	46,721	77,[illegible]24
Galvanized sheets	7,435	3,620	54,407	52,606
Tin plates	42,731	54 450	153,220	217,421
Cast, wrought, etc., iron	2 912	3,090	47,861	31,979
Old (for re-manufacture)	160	1,201	15,758	7,684
Steel	5,679	4,455	85,548	51,956
Lead	3,076	3,451	16,355	27,401
Tin, unwrought	6,631	2,380	20,208	17,369
Cement	1,735	1,306	32,766	19,797

Mining Matters.

THE mineral exports from Nelson, B C., during 1897, amounted to 53,971 tons, valued at $7,891,329.

A PLAN is proposed in Kingston, Ont., to open up the lead mines in Frontenac county and have the ore reduced in Kingston.

KOLIN, the clay from which porcelain is made, is said to have been discovered not far from Halifax, N S., and of the finest quality.

D A. JONES, Beeton, Ont., reports the find of an extensive area of quartz, rivaling the famous Hammond reef near Wahnapitae, Ont.

THE Le Roi mine has paid its regular monthly dividend of $50,000 in spite of the expense incurred in building the Northport smelter.

ASBESTOS, comparatively a new mining town near Danville, Que., claims to have a population of 1,500, and is seeking incorporation as a village

A TRACT of sand carrying alluvial gold is reported to have been discovered recently about ten miles from Chatham, Ont., in Raleigh township

A FIND of platinum is said to have been made about two miles in the interior from Stevenville, St George's Bay, Newfoundland, by Garret Dalton.

THE galena found on lot 9, con. 4, Calumet Island, Que., has assayed as high as $60 per ton in silver, with traces of gold. The outcrop is about 18 x 40.

THE Ontario Government diamond drill is working on a gold property known as "J C., 60," a few miles east of Rat Portage, owned by N B. Eagen, Toronto

C RIORDAN and J R Barber, Toronto, are promoting a stage line from Edmonton to Dawson, and the construction of a telegraph line They will organize a company, it is said

THE black gold-bearing sand which is attracting so much attention in the Saskatchewan is also found in many of the streams in British Columbia, notably in the Kootenay.

THE B.C. mine at Greenwood, B C., has ordered a complete development plant from the Jenckes Machine Co Sherbrooke, and work will be pushed on this property this winter.

W AUSTIN, Cardiff township, Haliburton county, Ontario, reports a find of ore including gold and copper on his farm Tests are said to show $16 80 in gold and $24 in copper to the ton

THE New England Gas Company has contracted with the Dominion Coal Company for 100,000 tons of coal to be delivered annually in Boston, with the option of taking 1,500,000 tons.

THE Le Roi Mines, Rossland, B.C., are extending their pumping system, and have placed an order through the Rossland branch of the Jenckes Machine Co., Sherbrooke, Que., for a large size special Knowles Sinking Pump.

THE Virginia Mines, at Rossland, B.C., have passed the preliminary stage and will now enter the list of shippers. An order for a large hoisting plant with boilers has been placed with the Rossland branch of the Jenckes Machine Co., Sherbrooke, and is now on the way from the East.

At Phillip's Arm, B.C., the British Columbia Gold Fields Company has established a trading post

Jas Conmee, M L.A., predicts that in a year and a half there will be 1,000 stamps at work in the Rat Portage district of Ontario.

W. A. Hungerford is going to smelt the gold-bearing ores of Hastings County, it is said, on a small scale near Millbridge, Ont.

Extensive deposits of bituminous coal have been discovered at Dominion City, thirty miles from Winnipeg, at a depth of a hundred feet.

A E Hodge, representing a large English company, has recently examined the pay bars on the Saskatchewan River, with a view to putting in gold dredging machinery on a large scale in the spring.

The final clean-up of the Cariboo Hydraulic Mining Co was made on Nov 11th The total yield of the season was $139,000. The water supply was only about half that of last year and the output was very much restricted thereby

The Fern mines, Hall Siding, Rossland district, B.C., are lighting up the mill and yards, as well as the tunnel of the mine, by electricity, and have placed the order for machinery and apparatus with the Royal Electric Company, Montreal.

A seam of coal found near Sydney, N.S., by E T. Mosely, will largely increase the coal area of Cape Breton. The seam is known as the Mullins seam, and is six and a half feet wide. It is 14 miles from Sydney, on the Cow Bay road.

The West Vancouver Coal Company, in which H C Haliday and other San Francisco capitalists are interested, will, it is said, develop their coal mines at the north end of Vancouver Island and establish a coaling station for Alaska steamers

A nickel smelter is proposed in Toronto, to cost $500,000 If an export duty were placed on nickel matte, it is thought that capital could be secured to carry on the smelting in Ontario R J. Tough is promoting the enterprise in Toronto.

The Ontario Lithographic Stone and Mining Company, Limited, has received an Ontario charter, $250,000 capital It is to be composed of A L Davis, H S. Macdonald, J W. Gray, R M. Dennistoun and F. J. Jameson, Peterboro, Ont.

A Drolet, manager of the Saskatchewan Gold and Platinum Mining and Dredging Company, has fitted up the Benoit & McKay dredge at Edmonton, N W T, at great expense, and it will be used in gold dredging and washing next season.

In the main shaft of the Foley mine, Lake of the Woods district, Ont., which is now being pushed towards the 400 foot level, there is 6½ feet of fine ore in the winze between the 200 and 300 foot levels, and four feet in the drift at the 300 foot level

The Jenckes Machine Co., Sherbrooke, are furnishing the Canadian Rand Drill Co., Halifax branch, with one of their 20-inch Crocker Special Turbines, to be used in connection with the extensive hoisting plant being installed by the Drill Co at the Torquay mines

A Mackenzie, Montreal, reports that gold is being washed successfully from the Saskatchewan River for 250 miles, the men averaging $1.50 to $4 per day each About fifty per cent of the gold is lost owing to its fineness The bars may be worked over year after year, it is said, and more gold will always be found

The officials of the Hammond Reef Gold Mining Company have announced the result of their first clean-up. From 259 tons of ore run through the ten-stamp mill five pounds (avoirdupois) of gold were caught on the plates. This is about $5 per ton, and with such a value the Hammond reef is a gigantic proposition, for the deposit is from 50 to 100 feet wide, and the ore can be mined and carried to the stock pile at less than 50 cents per ton.

The bond on the Lynn Creek properties, close to Vancouver, B C., has been thrown up. The ore is found to contain too much zinc to be profitably worked. This is not the case, however, with copper-gold properties on Texada Island and Phillip's Arm, situated several miles north of Vancouver Mining companies operating in these sections have shipped thousands of tons of ore as far away as Swansea and with fair results

It is stated that the New England Gas and Coke Co. will produce from the Nova Scotia coal coke, illuminating and fuel gas, tar and ammonium sulphate—70 per cent. of coke, 10,000 feet of gas, 12½ gallons of tar and 28 pounds of ammonium sulphate to the ton of coal. One half the gas will be used in coking the coal, the rest will be available for the market and may be sold under the pipe line charter at not exceeding 65 cents per 1,000 feet

Major Hepman, of the Fourth Royal Fusiliers, and Capt. Alleyne, of the Twelfth Lancers have started from Edmonton for the Klondyke. The party consists of 14 men including two doctors, besides the packers, drivers, guides, etc. They have 120 horses, a number of dog teams, etc., and expect to put in a number of tons of supplies into Dawson After reaching Dawson they will survey the country east of the Yukon. Capt. Alleyne is also Reuter's correspondent.

The property of the old Frontenac Lead Mining Co., of Loughboro township, near Kingston, has been bought by some Toronto men who propose to organize and re-open the works under the name of the Frontenac Lead Mining and Smelting Syndicate. The late George Spotswood always contended that, under good management, which the old company never had, this lead mine would pay well, and the new company proposes to put this to the test by putting in a drift below the present workings.

The construction of the new reverberatory and calcining furnaces at the Hall Mines' smelter is being pushed, and it is expected that they will be completed in about two months. The large blast furnace made a run recently which broke the record, turning out 26 tons of matte in 24 hours. Everything is working smoothly and the ore treated continues to be of a very high quality. The management is smelting lead ores from the Slocan in the old 130-ton furnace, which has been converted into a lead furnace.

The Canadian Copper Company, an Ohio concern, and the Anglo-American Iron Company, which control the output of the nickel and copper mines around Sudbury, have special charters domiciling them in Canada on certain conditions, one of which was the establishment of smelting works for the reduction of the ores. It is claimed that in breach of that they have taken their ore to the United States and had it smelted there, and that they have spent in wages and railway freights about $1,250,000 a year in this way outside of Canada. B. B. Osler, Q.C., of Toronto has filed in the Department of Justice, at Ottawa, a petition to the Attorney-General of Canada for leave to bring an action against these companies to revoke their charters.

The Dominion Coal Co., in reply to the criticism regarding the closing of its two collieries at Port Morien and Victoria, states that a new shaft will be opened in a more central part of the coal producing district of Cape Breton. It is stated that the new shaft and equipment will cost $250,000, and two new washing plants will be erected at a cost of $50,000 each. Later on it is intended to build a pocket at Louisburg large enough to hold a ship's cargo of 6,000 tons, with apparatus enabling this quantity to be discharged into a steamer in six hours. For this purpose a new pier will be erected at Louisburg, the outlay at this port being about $250,000. Near Sydney the company is now building a pier to cost $50,000. Altogether the company asserts that it will spend $700,000 in the next two years.

The shipments of ore from Kaslo, B.C., are an indication of the value of the Sandon silver mines. During the month of October, the shipments amounted to 8,450,000 pounds, valued at nearly $400,000. Of this 2,784,110 pounds were lead, and 397,977 ounces silver. The record for the same month in 1895 gave 735,000 pounds of ore, and for 1896 the figures were 1,286,933 The shippers of ore in the Slocan district number over 40, and the mines that are paying dividends number 25. The records show 14 shipping mines for 1895, 39 for 1896 and 53 for 1897, though some of the shippers are not shipping regularly. Returns of ore shipped from the Slocan and Ainsworth mining district, taken from the custom house clearances for the nine months ending September 30th, 1897, show 47,435,000 pounds, valued at $1,853,000, as compared with 23,344,000 pounds, valued at $1,114,000, for the whole twelve months of 1896.

The Calumet galena mines, though owned by men in the neighborhood, is now being worked by a Belgian. The product is a conglomerate of lead and zinc ore containing from seven to twelve per cent. of silver but about the total wealth of the mine it is at present impossible to form an opinion. The property on Chats Island is that in which Jas Robertson, of Montreal, is interested. There is an immense deposit of pure galena without any admixture of zinc. It is easily obtained and requires but a small outlay of capital. A recent find has given the proprietors a new impulse, and it is very probable that the mine will be opened up at an early date. Mr. Tough, a well-known owner of mining property in the Sudbury district, also possesses a mine on this same island, containing a deposit of much the same character as that in the aforementioned mine. The extent of this deposit cannot be known till next spring, when the snow has disappeared. The operation of extracting the valuable metal from this ore has been somewhat difficult hitherto, but a new method has recently been discovered in Germany, which will be adopted in the cases of these mines

A. J. G. Swinney, manager of the Canadian Gold Fields, Limited, Deloro, Ont., told the Toronto *World* recently, that the syndicate has already expended $500,000 in securing control of several square miles of territory in opening up the same, sinking shafts, installing machinery, etc. With this as a beginning, the company will not cease their outlay

until the mines have attained a producing capacity of $5,000 or $6,000 per day The underground work done on the property at present consists of two shafts, located a mile or so east of the reduction plant at Marmora Station, on the Central Ontario Railway, but four additional shafts are forthwith to be sunk—two near the old shafts, and the other two a mile to the north and a mile to the south thereof respectively. In order to carry on this work expeditiously, Mr. Swinney has arranged for the immediate installation of a twenty-drill air compressor. And when, with this extensive mining plant, a big ore reserve has been obtained, the capacity of the bromo-cyanogen mill will be increased, so that it will treat 400 tons per diem. Mr. Swinney says that the mispickel averages $15 per ton in gold, and that the new process saves 85 per cent., or over $12 of this. This means, as stated above, that the enlarged mill should turn out between $5,000 and $6,000 in bullion each day. It is also learned that the same money that is invested at Deloro is behind the re-opening of the Belmont gold mines, located nine miles to the northwest of Marmora Village, and formerly owned by A. W. Carscallen, M.P. The Belmont ore is concentrating, and a stamp mill is being erected upon the property.

Electric Flashes.

WALTER MCFARLANE is putting the electric light into his factory at St. Mary's, Ont.

THE Carleto[illegible] council threw out the by-law to grant a bonus to the Lanark C[illegible]ty Electric Railway Co.

THE Canadian General Electric Company has installed an isolated plant for A. & J. Clarke, Bullocks Corners, Ont.

THE Cardinal, Ont., starch works is putting in an electric light plant of sufficient power to furnish the works and the town with light.

ENGINEER CHURCHILL, of the S.S "Iceland," is now in charge of the electric light station, St. John's, Nfld., in place of J. Hepson, resigned.

THE Pontiac Telephone Co. is putting telephones in each of the stations along the line of the P.P.J. Railway from Quyon, Que., westwards.

THE town council of Parrsboro, N.S., has been authorized to spend $8,000 in equipping an electric light plant, to be the property of the municipality.

ST. THOMAS, ONT., has voted to guarantee $50,000 of the bonds of the new electric street railway company, and to pay the first year's interest on them.

THE Windsor Plaster Co., Windsor, N.S., is lighting its works by electricity, and has given the order for the electrical equipment to the Royal Electric Co.

THE Toronto Electric Motor Co. is now running night and day, and notwithstanding recent enlargement of the works is scarcely able to keep up with orders.

THE Dominion Paper Mills, Kingsey Falls, Que., are installing an electric lighting plant in their new mills, and have placed the contract with the Royal Electric Co.

IT is proposed to extend the Belleville, Ont., Street Railway to Trenton and Tweed, using rails sufficiently heavy to allow of the C.P.R.'s hauling freight over the line.

THE Bell Telephone Co. will shortly put up for its Quebec headquarters a new office building, on the corner of St. John and St. Angele streets, Quebec, at a cost of $15,000.

THE St. Jerome Power and Electric Light Co. has had such success in canvassing for lights that it has changed its order from 1,000 light "S.K.C." machine to one of 1,500 lights capacity.

THE St. Lawrence Power Company is applying to the Quebec Legislature for incorporation, for dealing in water, electric, steam and any other power for lighting, heating and manufacturing.

C E SHEDRICK, who has assumed control of the Whitney Electrical Instrument Co., Sherbrooke, Que., has on hand a stock of measuring instruments, laboratory apparatus, X-ray apparatus, etc.

THE British Columbia Iron Works Company, Vancouver, B.C., have placed an order for a 10-kilowatt, direct connected, steel frame, incandescent lighting generator with the Canadian General Electric Company.

THE expenses of the municipal electric light plant of Lachine, Que., in 1897 amounted to $3,282, the lighting being $50 electric lights and 43 arc lamps for the entire town. The receipts for the same year mounted to $3,066.

THE Canadian General Electrical Co has recently installed a 250-light plant in the premises of the Northey Manufacturing Co., Toronto.

THE Seine River, Foley and Fort Frances Railway Company, is applying for an Ontario charter to build a line from Bonheur on the C P R., to Sawbill Lake, Fort Frances, etc., and to dispose of surplus electricity for power and other purposes.

THE Shipton Electric Co., Danville, Que., has decided to proceed with the extension of the power plant this winter, and has made a contract with the Jenckes Machine Co, Sherbrooke, for a Crocker turbine, horizontally set, with penstock and draft tube complete.

THE officers of the Sherbrooke, Que., Street Railway Co. are: President and chief engineer, John W. Burke; directors, Percival W. Clements, Rutland, Vt., Edgar Harding, Boston; Walter Blue, Wm. Morris, Sherbrooke, superintendent L E. Whitehead, secretary, F. J. Griffith.

BOBCAYGEON, ONT., has a scheme to secure electric railway communication with Peterboro. The proposal is to build a line to Scott's mills, some twelve miles east, then south to Buckhorn, and on to Peterboro. It has been estimated that the line can be built for less than $200,000.

THE Edmonton Electric Light Co., of Edmonton, N.W.T., is improving and extending the plant. The new electrical equipment bought by them from the Royal Electric Co., consists of one 75 K.W. "S.K.C." two-phase generator, complete, with exciter and switchboard, as well as the necessary material for the other changes.

THE Canadian General Electric Company has recently closed a contract with the Bushnell Oil Company, Sarnia, for a 25-kilowatt direct connected, steel frame, incandescent lighting generator, coupled to an "Ideal" engine. This installation will embody all the latest improvements in direct connected practice, which the Bushnell Company, from its connection with the Standard Oil Company of the United States, has learned to value through their experience there.

THE turning on the power and light in connection with the new municipal electrical lighting plant, at Magog, Que., was made the occasion of a reception given by the Mayor and Councilors in the Opera House. The hall was brilliantly lighted by incandescent lamps, and the whole town turned out. Speeches were made by Mayor Bessette and other councilors and a very pleasant evening was spent. Magog is one of the first towns in the Eastern Townships to own and operate its own lighting plant. The power is obtained from the Magog River, a little below the cotton mills. The water wheel plant of the Crocker special type was furnished by the Jenckes Machine Co., Sherbrooke, Que.

THE Canadian General Electric Company is supplying a 1,000 light direct connected, incandescent lighting plant for the Gutta Percha and Rubber Manufacturing Co. This installation will be, when finished, one of the most complete in the country. The machine is of the steel frame, ventilated, armature type, direct connected to an "Ideal" engine, running at the slow speed of 280 revolutions per minute. The great saving in space, durability and high efficiency obtained by the use of these direct connected units has led to their adoption as the standard machine where it is desired to obtain the best and most economical conditions in operating an isolated incandescent lighting plant.

THE Packard Electric Company, Limited, St. Catharines, Ont., announces that it has recently imported from England a sand blast frosting machine, which it is claimed produces frosted lamps far superior to those which have been previously placed upon the market. The effect produced by frosted lamps is appreciated by everyone, but their use in the past has been exceedingly limited, both on account of the inferior class of work in this line, as well as the price charged. The company is also in a position to do any style of fancy frosting, bringing out letters, monograms and any desired design, upon lamps to be used for decorative work. The fine frosting, which this up-to-date machine produces absorbs much less of the light than any ordinary frosted lamp.

THE plant and franchise of the Temple Electric Co., Montreal, have been acquired by the Standard Light and Power Co. The Lachine Rapids Hydraulic and Land Co. have made a contract with this company to supply it with current from the Lachine Rapids and the steam plant will be sold. The Lachine Co. has also closed a contract with the Imperial Electric Co., formerly the St. Jean Baptist Electric Co., to supply it with current, replacing the present steam plant. Although the thermometer has been down below zero this winter, no difficulty has been encountered with frazil ice.

E RUTHERFORD, electric supplies, Peterboro Ont., has assigned to R R Hall.

M. S CORNELL, Stanbridge East, Que., is planning to install a lighting plant next spring.

G C HINTON & Co, Victoria, B C., are wiring the Jubilee Hospital there, and supplying the fixtures

JACOB UNSLEY has installed an electric lighting plant in New Hamburg, Ont., which is proving satisfactory.

NEIL & KENT, Granby, Que., have placed the contract for lighting their factory with Allen Taylor & Co., Waterloo, Que

THE C P R. Telegraph Company has built a line from New Denver to Nelson *via* Slocan City. This line not only increases the capacity of the Kootenay systems but gives an alternating wire to the main line *via* Revelstoke.

THE Richmond Light and Power Co., Richmond, Que., is adding to its electric lighting equipment, and has placed with the Royal Electric Co, Montreal, an order for a 75 K W. "S K.C." generator and switchboard complete.

A. H. ST GERMAIN, North Toronto, is about to organize an auto-car service between York Mills and Toronto He has ordered three electric busses, each capible of carrying 30 passengers, from an English firm and they will be delivered in Toronto before next spring

A COMPANY has been formed to build an electric railway between St Catharines and Port Dalhousie H D. Symmes, manager of the St Catharines and Thorold Railway, has let the contract for the cars required for the new line, and will shortly let contracts for four miles of rails, 9,500 ties and 300 poles, wire and bonding, also a 100 k w. railway generator and several 35-h p motors.

THE Stevens Manufacturing Co., of London, Ont., has put in dynamos for a 500-light plant for Walter Steward, Lucknow, Ont., who will supply the village with electric light. The same company has put in a 300-light plant for the village of Glencoe. The wiring in connection with these two contracts has been done by the Rogers Electric Co., of London

THE proposed Smith's Falls Rideau and Southern Electric Railway is to be in the town of Smith's Falls, Ont., with extensions to Lombardy, Oliver's Ferry, Portland, and to Rideau Lake, Harlem, Chantry, Frankville, Toledo, Newbliss, Merrickville, Burritt's Rapids, Oxford Mills, Bishop's Mills, Easton's Corners, Irish Creek and other points within the counties of Leeds Lanark and Grenville.

THE Toronto and York Radial Railway Company applies to the Ontario Legislature for a charter to amalgamate the Toronto and Scarborough Electric Railway, Light and Power Company, Limited, the Toronto Belt Line Railway Company, the Metropolitan Street Railway Company of Toronto; the Toronto and Mimico Electric Railway and Light Company, the Toronto Suburban Street Railway Company, Limited

THOS L KAY, the well known electrician, formerly of the Kay Electrical Manufacturing Co, has recently severed connection with that firm, and is now with the Canada Electric Motor Co, who have recently started in Hamilton with good prospects The following are some of the plants just finished —John Duff & Son, grocers and butchers, 208 and 210 York Street, Hamilton, a 150-light dynamo with 150 incandescent and one arc light, the whole work done by the Canada Electric Motor Co A 100-light dynamo with a number of incandescent lights installed at the waterworks of Hamilton. A motor for the St. Catharines Electric Railway. The repair of a 250-horse power generator, 8-h p. motor for Leitch & Turnbull, elevator, motor for Bradt, grocer, a 10 light dynamo for Lees & Son, bakers, and various others. Mr. Kay is one of the pioneers in the electric business in Canada. He started in a small way on the corner of Bay and Market streets, Hamilton, in 1880, and has been connected with the business ever since. Mr. Kay was the first to exhibit a successful light in Hamilton. There were very few electric lights in Canada when he introduced his light, and now there is hardly a city or town in the Dominion where there is not a machine of his design in use. Mr. Kay has devoted the whole of his attention to electricity, the building of electric machines of all kinds alternating or direct current dynamos, motors, transformers and all kinds of electric work. Any work entrusted to the Canada Electric Co. will receive Mr. Kay's careful attention. The works of the new company are at 32 and 34 Bay Street North Mr Kay has associated with him T. O. Apps, who has had considerable experience in the business department of electrical work. Mr Apps is secretary-treasurer of the Canada Electric Motor Co

Railway Matters.

THE G.T.R. recently brought a car load of fruit from Portland, Me., to Hamilton, Ont., 670 miles in 32 hours

ON the eastern section of the Grand Trunk the old eight-wheel freight engines are being done away with and replaced by ten-wheel engines.

THE Signal Engineer Hodgson, of the G.T R engineering department, has completed the work of putting in at Woodstock, Ont., interlocking switches

IT is the intention of the Canadian Pacific Railway Co. to keep the shops running in Winnipeg all winter, fitting up locomotives and cars for the spring traffic.

A BONUS of $75,000 to the Ottawa and New York Railway, to establish workshops in Ottawa, has been adopted by the property owners by a majority of 928.

SINCE the first of January the Intercolonial Railway, the Prince Edward Island Railway, and the leased lines, are known as the Canadian Government railway system

THE Quebec Government has refused the $250,000 promised to the Victoria Bridge by the late Government, and also the $250,000 promised the Drummond County Railway.

THE I.C R. management expect to reduce the number of engines between Halifax and Montreal by half, through the new and improved type recently adopted The number now in use is twenty.

THE Grand Trunk has received 500 freight cars of 60,000 pounds capacity each, built by the Michigan Car Company, Detroit. Another lot of 500 freight cars are being built in the Canadian shops of the system.

THOS TOMPKIN, Brockville, has been awarded the contract for the erection of a station for the C.P.R. at Vancouver, B C., also for a number of other buildings for the company in different parts of that Province.

PUBLIC meetings have been held in Toronto, and resolutions passed favoring the building of a railway to James Bay. A great deal was said about aid from the Dominion and Ontario Governments and the Toronto city council, but none of the promoters said what amount of money they were prepared to invest in what would undoubtedly prove a most valuable addition to the Canadian railway system.

THE Nova Scotia Midland Railway Company, composed of Wm Strachan, Jno. Beattie, P. Lyal, D. L. Lockerby, Wm. Mackay, S. H. Holmes, and B. F. Pearson, has signed an agreement with both the Dominion and Nova Scotia Governments, each of which subsidize the road to the extent of $3 200 per mile, for the construction of a railway from Windsor, N.S., to Truro W. G. Reid, Montreal, has the contract to build the Midland, which is 50 miles in length.

APPLICATION will be made at the next session of Parliament by the Hudson Bay and Pacific Railway Co. for an act of amendment to their charter empowering them to abandon that portion of their projected line extending from Prince Albert to Calgary, and to establish in its stead a branch between Prince Albert and Edmonton, and also to lay out a line from Edmonton to a point on the eastern boundary of the Province of British Columbia

ONE issue of the *Canada Gazette* contained the following applications for railway schemes in the Yukon and Kootenay countries. The Klondyke Exploration Company of London, Ont., asks for letters patent authorizing them to acquire lands and facilities for mining, smelting and transportation purposes The applicants are. J. M. McIntyre St Thomas, J A Moody, London, D. A. McIntyre, St. Thomas R H Marshall, London, and G M. Fox, London. Molyneau St John gives notice of application to Parliament for the incorporation of a company to construct a tramway between the head of Lake Lindemann and the mouth of the Lewis River, to avoid the White Horse Rapids and other obstructions to navigation. Lafleur & Macdougall give notice for a company to operate a railway from Fort Selkirk to a point on the international boundary, on a route towards the mouth of the Stickeen River by way of the Hootalinqua River and Teslin Lake, with branch lines A company applies for a charter through Geoffrion, Dorion & Allan, of Montreal, to build a railway from a point on the Lewis River, between Five Fingers and Fort Selkirk and a point on the international boundary, on a route towards the mouth of the Lynn Canal, with branch lines Notice is also given of application for an act to incorporate a company to build a railway from the head of the Lynn Canal northward along Dalton's Trail to Fort Selkirk, N.W.T.

Marine News.

THE contract for masonry on the Soulanges Canal, recently taken rom A. Stewart, has been re-let to Ryan & Macdonald.

WOODEN ship-building is being carried on with renewed vigor in Newfoundland this season. Most of these schooners are for the Labrador trade.

THERE is a rumor of a new Canadian freight line between Halifax and Liverpool, but the parties whose names are mentioned, are reticent about giving information.

JOHN & MICHAEL O'LEARY have completed their contract on the Soulanges Canal, which covered section No. 3, the approximate value of the work being $230,000.

H E GIDLEY, Penetanguishene, Ont., is building a fine steam yacht for W. A. Gorby, Marion, Ind. She will be fitted with compound engines and a water tube boiler.

THE Albion Iron Works Co., Victoria, B.C., is fully employed building river steamers for the Yukon and Stickeen Rivers for the C.P.R., the Hudson's Bay Co., and others.

THE Donnelly Wrecking Company, which made arrangements to release the stranded steamer "Rosedale" for $17,000, has succeeded in placing the steamer in the dry dock at Kingston.

THE Klondyke Trading and Transportation Corporation, which Sir Charles Tupper organized, has purchased the first-class steamer "Amur" from Labaun. She will run to Stickeen and to St. Michael's.

J. H. MOIR, of New Westminster, B.C., has been awarded the contract for the construction of two stern-wheel steamers for the Stickeen River route by the Hudson's Bay Company The steamers will cost about $20,000 each.

THE Hon. J. R Thibaudeau, the Hon. A. A. Thibaudeau, C. N Armstrong, E A. D. Morgan, Montreal; R. Audette, Quebec; and L. H. De Friese, London, Eng., have applied for letters patent as the Atlas Steamship Company. The chief place of business will be Montreal, and its capital $500,000.

CAPT. C. H. MCLEOD, Pictou, N.S., is now at Portsmouth, New Hampshire, where a party of Klondykers is being fitted out. The captain has secured an engagement to take a vessel round Cape Horn, or through Magellan Straits, and the party expects to be at the mouth of the River Yukon when navigation opens.

THE London manager of the Canadian Pacific Railroad confirms the report that the company has bought from the Union Steamship Line the steamers "Tartar" and "Athenian," formerly the favorite liners in the South African mail service, and will establish a regular freight and passenger communication between Vancouver and Fort Wrangel, at the mouth of the Stickeen River. Each will do the trip within three days.

A CHARTER has been granted to L. L. Beer, C. Palmer, G. J. Rogers, J. Pitblado, W W. Beer, T. W. Dodd, A. Kennedy, W. Welsh, R. Fraser, F. L Haszard, Charlottetown, P.E.I., to acquire by purchase, lease or otherwise, and to build steamships and other vessels, docks, wharves and other terminal facilities, and to carry on the business of a transportation company for transport of passengers and freight, as the Inland Navigation Company, Limited, with a capital of $13,200.

FOLGER BROS., Kingston, Ont., have bought the steamer "Shrewsbury" and will put her on from Clayton to Montreal, along with the "America" during the coming season. The "Shrewsbury" was built at Bath, Maine, at a cost of over $80,000 about a couple of years ago and has been in commission only a short part of the time since. Her dimensions are 161 feet 6 inches length of keel, 26 feet 6 inches beam, 7 feet 3 inches depth of hold and 47 feet 9 inches over guards. She has compound engines of the inclined type, 25 x 46 inches, six-feet stroke. There are two boilers, Worthington condenser, steam steering gear, improved feathering paddles.

AT a meeting of the board of directors of the Richelieu & Ontario Navigation Company, it was determined to call the new steamers to be built in Toronto the "Toronto" and the "Kingston." It was resolved to make repairs to the steamer "Laprairie." She will receive new feathering wheels. Other improvements to the western fleet are now in contemplation. The details in connection with the outfit of the company's steamers generally, the improvement of their appearance, and the interior of the saloons, especially on the "Quebec," and new conveniences for state-rooms, were also resolved on. Alterations to the steamer "Berthier" will also be gone on with, with a view of increasing her speed and carrying capacity.

THE C P R has completed arrangements in Toronto, for the construction of three light draught stern-wheel steamers to ply in Alaskan waters, in conjunction with the two ocean steamers which they have purchased in Scotland. These vessels will be constructed in Toronto, the contracts having been let to the Bertram Engine Works Co. for two boats, and the Polson Co. for one boat. The plans have all been prepared, and work will be commenced at once, as it is intended they shall be ready for the opening of navigation. The boats are of wood, plated with steel, and will have a length of 156 feet, with a beam of 30 feet. They will be put together in the Toronto yards and will then be taken apart and the parts shipped to Vancouver. The two ocean steamers' run will be from Vancouver to Wrangel, at which point passengers will be transferred to the new light-draught boats, which will ply on the Stickeen River. Captain Troop, who is superintendent of a line of steamers plying in the Kootenay district, has been, it is understood, given the position of superintendent of the new line of C.P.R. steamers in Alaska.

Personal.

W. W. Ogilvie has presented another $1,000 to the Winnipeg general hospital.

MANAGER SKIDMORE, of the Waterworks Company, Berlin, Ont., will leave shortly for the United States.

A. MCDONALD, contractor, Woodstock, Ont., was killed by a G.T.R. train at a level crossing in Woodstock, Dec. 15th.

MORTON WEBB, mining engineer, son of F. R. Webb, Petrolea, Ont., returned from Colorado for the Christmas vacation.

JAMES LAMOND, formerly with E. Leonard & Sons, London Ont., has accepted a position with the Goldie McCulloch Co., Galt.

R. MAITLAND ROY, Peterboro, Ont., who has been connected with the engineering staff of the Central Bridge Co. for a number of years, has accepted a responsible position with the Hamilton Bridge Co., and will remove to the ambitious city.

WHILE visiting at the house of a friend in Toronto, Sylvester Neelon, well known as a member of the firm of Elliott & Neelon, contractors for the masonry work at the new municipal buildings, died suddenly of apoplexy. The body was taken to St. Catharines for burial. He was 74 years of age, had lived in St. Catharines for half a century, and was prominently engaged in extensive milling and timber business. He built the large Empire flour mills, which are now occupied by the Packard Electric Co., St. Catharines. He represented the county in the Ontario Legislature. He was president, up to the time of his death, of the Niagara Central Railway Company, and it was through his work that the road was built.

HURD PETERS, engineer in charge of the harbor improvements at St. John, N.B., was the recipient of a pleasant attention from the men employed on the works. The men employed about the works assembled in the warehouse and D. C. Clark, in their behalf, read an address to Mr. Peters, expressive of appreciation of his services, his constancy in attending his duty, his zealous care in the city's interests, and his pleasing manner, which had been an encouragement to them. Mention was made that the relations between Mr. Peters and the men had always been of the most pleasing character. The address was signed on behalf of the workmen by D. C. Clark, foreman of wharf construction; Thomas Thompson, foreman of warehouse construction; D. W. Clark, superintendent of pile driving, James McMurray, captain of dredge "Cape Breton", John W. Dickinson, captain of dredge "Freeport", James Fennell, captain of dredge "H. F. Bothfeld"; Frank S Henrion, diver. Accompanying it was a gold headed ebony cane, suitably inscribed, also a silver ice pitcher. Thomas Thompson made the presentation of the pitcher and D. W. Clark the cane. Mr. Peters said it was usual on occasions of this kind to say it is unexpected and surprising. All can bear me out, he said, that this is utterly and absolutely true in this instance. For forty odd years I have been connected with the city's work, and sometimes have done good work, and always have had pleasant and cordial relations with the men, but never till now have they given expression to it, and that I appreciate it you must know. My schoolboy holidays were spent in Carleton from the time I was ten years of age, and I have had a great deal to do with Carleton from the time I put in the waterworks, and have always found the workmen competent and efficient. A report I prepared some time ago for presentation to the harbor improvements committee gives expression to my opinion of the excellent way in which you have worked. It gives all due credit to the foremen, but shows that the completion of the work is due to the men, who throughout have shown a friendly spirit and have worked with vigor and energy. Never was more work done, and better done, in five months; and every man who

used an axe or an adze has earnestly done his share in bringing it to a successful conclusion Mr. Peters concluded by again thanking the men and assuring them of his good wishes, and declaring if the city undertook, as he hoped it would, the completion of the work on the other side of the slip, that they were the men for it

—Every manufacturer of first quality paving brick is directly interested in establishing a uniform method of testing paving brick, as a matter of self preservation, for uniform tests mean impartial comparison. Hence, it behooves paving brick manufacturers, or municipal officers and city engineers to have a copy of the Report of the Paving Brick Commission It is a neat book of 110 pages, containing all of the comparative tables and charts compiled for the National Brick Manufacturers' Association of the U. S by a special Commission, under the direction of Prof Edward Orton, Jr. The universal adoption of the methods recommended by the Commission will redound to the credit of paving brick and to the profit of the manufacturers. Copies may be had through THE CANADIAN ENGINEER at $1 00 per copy.

—We have received the fifty-first volume of the Canadian Almanac from the publishers, Copp, Clark Co. Limited, Toronto Besides being a directory of clergy, militia, Government officials, members of Parliament, county and municipal officers, schools and colleges, barristers and solicitors, and other public men, it is a compendium of information of all kinds relating to Canada Some of the more prominent departments are. Short History of Canada, Tariff of Customs Forms of Government throughout the world, Post Office Gazeteer Masonic Lodges, Miscellaneous Societies, Historical Diary, Life Insurance. Some new features for 1898 are Short accounts of the British Army and the British Navy, with illustrations; also articles on the English Government, and Extraditions and Pardons. Besides the above, with every copy of the Canadian Almanac for 1898 is presented a map of North America, beautifully engraved and printed in five colors. The price, 25 cents.

—The annual meeting of the Atlantic and Lake Superior Railway was held in Montreal, on the 3rd inst. The President in his report said the arrangement made by Mr. Armstrong with the London syndicate was, for the present, a confidential document; but under the agreement, the company had constructed 20 miles of road between Caplin and New Carlisle, and trains are running on that section Two parties of engineers are about to start locating the line between Paspebiac and Gaspe. The line as far as Port Daniel, 25 miles long, is an easy section, but between that point and Gaspe several surveys will have to be made before the best route can be selected. The company has also done considerable work between Yamaska and Levis on the Great Eastern Division, grading being nearly finished between the St. Francis and Nicolet Rivers. Traffic will be open between Nicolet and St Gregoire, and to St Angele, opposite Three Rivers, this month. The directors have bought from the C.P.R. the section of the South Eastern between Sorel and Yamaska, including the Yamaska river bridge This makes a connection with the South Shore Road, and the C.P.R. and United Counties Railway will pay for running rights over it The section between Yamaska and Levis will probably be finished before the close of 1898, and wharves, warehouses, etc, will be constructed at Paspebiac, and the Government will be asked to assist in building this port The section between Riviere du Loup and Metapedia will be 115 miles, or 60 miles shorter than the Intercolonial between the same points This country is as yet unsettled, but is well timbered and watered, and the soil is rich. The following officers were elected President, Hon J R Thibaudeau, first vice-president, Hon. Wm. Owens; second vice-president, Hon. V W Larue, secretary, E N Armstrong; general manager, C N Armstrong The three representatives of the Quebec Government, Hon V W. Larue, Jas. Baker, and Chas Chaput, were continued in office

Industrial Notes.

F J HENDERSON is building a butter factory at Gananoque, Ont.

THE town of Goderich is applying to the Ontario Legislature for authority to spend $50,000 in building a grain elevator

THE E. B Eddy Co., Hull, Que., has, it is said, entered the Diamond Match combination and will greatly enlarge its premises as a consequence.

THE city of Hull, Que., has ordered 500 tons of pipe from the St Lawrence Foundry Co., Toronto. The pipe will be in sizes running from 3 to 15 inches.

THE Victoria, B.C, Metallurgical Works Co, Limited, has been incorporated

H C McBRIDE, architect, London, Ont., won the competition by his plan of the Jubilee Hospital for that town.

THE Auburn Woolen Mills, Peterborough, are putting in an improved system of fire protection, and have ordered a number of hydrants, check and gate valves, from the St. Lawrence Foundry Co, Toronto

THE Hamilton and Toronto Sewer Pipe Co. is now building an up-to-date factory, which will enable them to maintain in future the excellence of their product in the past, in the meantime, stocks on hand are sufficient for the trade till the factory is completed.

ACETYLENE gas is said to be making headway in many parts of Manitoba, particularly at Morden where the apparatus is manufactured The underwriters' regulations for the use of acetylene are, our readers will remember, much less severe in Manitoba than in Ontario.

THE E B Eddy Company, Hull, Que., is adding eight new 5x14 feet tubular boilers to the battery of 24 boilers. The new boilers are to be used as auxiliary to the present water and steam power plant, and will drive some of the small paper and printing machines, and the pumps and engines

THE Verity Plow Company has decided to remain in Brantford. The company wants $15,000 for the old buildings, exemption from taxes and free water, an 8-inch main being necessary for the new works The building they will erect is to cost not less than $40,000. The company will give $10,000 guarantee that they will remain in Brantford for five years, and a $5,000 guarantee for five years longer.

THE property of the Guelph Norway Iron and Steel Company was sold a short time ago for $9,700 to John Taylor, formerly employed by the compan Forty-eight thousand dollars was invested in the enterprise. Work on the building was commenced in May, 1895, operations began in January, 1896, and the mill ran off and on until May, 1897, when it was closed. The stockholders will lose everything, it is said, and the creditors get about eighty-five cents on the dollar.

A FLOOD was caused at Norwood, Ont., Dec 15th, when the dam of the pond used to run Jas Cummings' woolen mills gave way, and coming in contact with Nield's foundry, owned by J. L Squier, it completely demolished it. Part of the stream entered the woolen mills and did considerable damage. The water carried away three bridges, and hundreds of cords of wood owned by J. Finlay & Son, Squier Bros., and James Cummings.

F E DUCKHAM, engineer of the Millwall Docks, London, England, was in Kingston, Ont, recently, with the view of getting the Canadian Engine and Locomotive Works for the building of two Duckham pneumatic grain elevators for the Montreal Pneumatic Grain Elevator Company The pneumatic elevator, in addition to pumping grain can transmit it horizontally 700 or 800 feet along a pipe to the warehouse and elevate it to a height of 80 feet to various bins In loading vessels it can, it is said, handle grain at the rate of 180 tons per hour, screening, grading and weighing it in the transmission

THE organization meeting of the Jacques Cartier Pulp Co was held December 11th, 1897, when E Golf Penny, Wm. Law, and W. Currie were elected trustees and Geo McDonald, secretary, to carry on the business till incorporation is secured. This company will buy the pulp mill at St. Jeanne de Neuville, which has been sold to them by E. Bradley, C.E., for the owner, James Reid, of Quebec. The company proposes to put in new machinery to double the output. American and German experts have viewed this water-power and pronounce it unique, as nature has done most of the engineering work by a natural tunnel underground, about 600 feet long, producing a fall of 65 feet The future capacity of the mill will be ten tons per day, mechanical.

THE terms of the agreement entered into between Abbott & Co., Montreal, and the city of Kingston, Ont., relative to the removal of the works to that city, have been made public The company will be given a free site and a bonus of $50,000; the plant and machinery to be valued at $250,000 by a board of valuators, who will make their award ten days after the works are in running order. Abbott & Co. agree to carry on the business twenty-five years, and employ during the first year 125 to 150 hands The pay-roll is to range from $40,000 to $50,000. Before the end of the second year the company will employ from 175 to 200 men, their pay-roll to range from $50,000 to $60,000 The city will have the first lien on the buildings and plant to the extent of the bonus for the period of twenty years, and the works must be operated 275 days in each year.

PARRSBORO', N.S., will spend $4,000 on firehall equipment.

A PEQUEGNAT'S bicycle factory, Berlin, Ont., is being equipped.

JAS. CAMERON, Fallbrook, Ont., is starting a sawmill at Harper.

A NEW market building is proposed for Brantford, Ont., to cost $4,000.

THE city of Ottawa purposes to spend $70,000 on buildings in Lansdowne Park.

E. R. SIMPSON & Co., engineers and machinists have begun business in Berlin, Ont.

WINNIPEG will spend $700,000 on a system of water works, to be supplied from artesian wells.

THE Welland Vale Bicycle Co., St. Catharines, Ont., is manufacturing a chainless bicycle for next season.

THE Rathbun Company, Deseronto, Ont., has been shipping carloads of doors, etc., to South Africa, recently.

W. P. NILES may build a roller flour mill at Wellington, Ont., the village having granted exemption from taxes.

A. E. CARPENTER has sold out his interests in the Hamilton and Toronto Sewer Pipe Company to Henry New.

E. L. PERKINS and W. H. Heine are interested in organizing a wood-working company, at Norton Station, N.B.

THE Canada Screw Co., Hamilton, Ont., is applying for an extension o he exemptions enjoyed for some years past.

H. & F. GIDDINGS & Co., Granby, Que., will build a new furniture factory, 50 by 100 feet, and five stories high, in the spring.

THE Exploits Lumber Co. is to be incorporated to do a large lumber business in Newfoundland. The capital is English.

IT is said that a combine including every wire rod, nail, and other wire product in the United States will be in operation before Feb. 1st.

GEORGE MCARTHUR, St. John, N.B., has been awarded the contract for building Doran's Hotel, Windsor. The contract price is over $20,000.

THE work of enlarging and improving the Rathbun Company's cement works, at Napanee Mills, Ont., is being pushed by a large staff of men.

THE town of Wardner, B.C., which has grown up where the Crow's Nest Pass Railway is to cross the Kootenay River, is experiencing quite a boom.

THE Dominion Elevator Company is now erecting elevators at the following points: South Edmonton, 20,000 bushels; Laduc, Wetaskiwin, and Red Deer, 15,000 each.

THE town of Welland, Ont., is to be piped at once for a natural gas supply. The rates charged will be the same as in Dunnville, Ont., *i.e.*, $35 a year for furnace, $24 for a cook stove, $19 35 for a heater.

AN order has been received at the C.P.R. car shops, at Perth, Ont., to build 20 first-class passenger cars and 10 sleepers. Hitherto only freight and box cars have been manufactured at the Perth shops.

INCORPORATION has been granted to M. M. Boyd, W. T. C. Boyd, Bobcaygeon, Ont.; G. Boyd, J. Wickham, Toronto; J. D. Flavelle, and J. G. Edwards, Lindsay, as the Cowichan Lumber Co., Limited. Capital, $150,000.

THE case of Dale *v.* the Riordon Paper Mills, Limited, Merritton, Ont., has been settled for $1,500 out of court. James Dale, who was severely scalded at the mill some months ago, brought an action for $2,500 against the company.

J. T. CHILD, C.E., of Child & Wilson, Calgary, N.W.T., was at Lethbridge recently making an estimate of the probable cost of a system of waterworks for that town. Medicine Hat is also looking for a waterworks system, it is said.

C. GUIMOND, Beauharnois, C. F. Lalonde, Montreal; J. Leduc, J. B. Roy, Delia Rochette, Beauharnois, Que., are applying for a Dominion Charter as the Star Iron Company, Limited, to manufacture furnaces, etc. Chief place of business, Montreal; capital, $60,000.

THOS. DOHERTY, Sarnia, Ont., the inventor of the famous iron casting process, is now engaged upon the invention of a further improvement in this process of iron production, of which great things are predicted by those who have been given an inkling of the new idea.

THE creditors of Robert Saxby, engineers' supplies, Toronto, met recently, when a statement was presented showing liabilities of $3,200, with assets of about $4,000. The chief claims are. John Herrington estate $1 700, secured by a $1,000 mortgage and $300 note, endorsed, E. E. Cooch $550, Bank of Commerce $100, Royal Oil Company $125, and Robert Saxbury, jr., $300. The assets consist of land $3,500 and the remainder stock and book debts.

THE company which is working the peat beds near Welland, Ont., is going into the manufacture of artificial marble from gypsum.

THE city engineer, Montreal, has asked an appropriation of over $1,000,000, chiefly to be spent on new sewers and enlarging old ones.

THE town of Magog, Que., has recently installed a municipal electric lighting plant, and now proposes to add a system of water supply, the same power plant being used as for the lighting system, and the pumping being all done during the day when there is no demand for electricity.

J. M. LAVOIE, E. Lavoie, O. Matton, Ottawa, A. Lavoie, Donald, B.C.: J. M. McDougall, Hull, Que., have been incorporated under the Dominion statute as the Lake Deschenes Milling Company, Limited, with a total capital stock of $40,000, to build flour and other mills, and do a general milling business.

THE average nightly attendance at the Toronto Technical School was 230 during October and November. The building is to be enlarged for the use of the school by the University of Toronto, which owns it, at an expense of $26,000. The Technical School will pay a rental of $2,000 per year for 21 years.

PLANS have been brought forward for extending the Bonsecours market, Montreal. The plan would extend the market to Jacques Cartier square, and then take in property and land on St. Paul, Bonsecours and Leroyer streets, extending the latter street through to Bonsecours street; a large square would thus be added to the market.

THE Ontario Sewer Pipe Company, Mimico, Ont., has completed what is said to be the largest sewer pipe kiln in the world. It measures 36 feet 7 inches in diameter, seven inches larger than the one built by the Great Western Sewer Pipe Company, Ohio, and about 19 inches larger than those of the Black Horse Sewer Pipe Company, Virginia.

THE Acton Tanning Co. and Beardmore & Co., Acton, Ont., are putting up new buildings. The carpenters are busy on two new hair houses, one for each establishment, 32 x 50. J. A Speight & Co. are finishing two large cedar water tanks for the Acton Tanning Co., fifty-seven feet in circumference and twelve feet deep.—*Acton Free Press*, Nov. 25.

A NEW company has been formed to operate the Coldbrook Rolling Mills, near St. John, N.B. The new company, which is styled the Coldbrook Steel and Iron Company, has appointed W. H. Thorne & Co., wholesale hardware merchants of St. John, as their selling agents. The company will manufacture bar iron, railway spikes, and wrought spikes.

A PRACTICAL demonstration of a new process of jointing pipes took place recently at the Caledonia Iron Works, Montreal, in the presence of some influential pipe-makers, contractors and others. The process of making and fixing the ring joint is an entirely new departure from the customary methods employed in jointing pipes, and overcomes the difficulties incidental to pouring and caulking lead into pipe joints in wet trenches. A full description of this process appears in THE CANADIAN ENGINEER. The inventor is D. J. Russell Duncan, C.E., 28 Victoria street, London, S.W. The ring joint is made with cold sheet lead, which is circumferentially contracted and indented by the pressure of a contractible tapering wedge and an external compression ring.

IN connection with the mention made in past issues of THE CANADIAN ENGINEER of the different appearances of strange aerial bodies, by many believed to be air-ships, the following press despatch, dated from Pittsburg, Pa., may be of interest: "It has at last been discovered who the incorporators of the Atlantic and Pacific Aerial Navigation Company are. The company, which is officered by C. A. Smith, president, and M. A. Terry, secretary, both of San Francisco, was organized to manufacture the air-ship of Hiram S. Maxim, inventor of the Maxim gun. It is said by persons connected with the company that last summer a trip was made in a Maxim air-ship from San Francisco to Cleveland and back in three days. Mr. Maxim furnishes the following description of his vessel: It occupies 106,000 cubic feet of space. The propelling power is a 105 horse-power naphtha engine. The cylinder engine and all other parts of the machine, so far as practicable, are made of aluminum, which was purchased of the Reduction Company here. The ship now weighs about 5,000 pounds, and will, its friends claim, carry more than a ton-weight of provisions and passengers. The naphtha for the engine will be stored in cases, which are supposed to hold enough to drive the ship around the earth without replenishing the tanks. The tail that projects upwards from the stern of the ship is intended to direct it up or down as a bird directs its movements with its tail. The rudder is to change the course from right to left. Motive power is secured by the big aeroplane at the stern, which is driven by the naphtha engine. It is stated that a speed of one hundred miles an hour has been attained without straining the machinery."

MONAGHAN & SUTHERLAND, contractors, Halifax, N.S., assigned not long ago to T. Frank Courtney.

THE Strathroy Furniture Co. is building a sawmill in connection with its factory, capacity, 15,000 feet per day.

RICHARD SCHOFIELD, Toronto, recently put in an electric mail-marking machine in the Hamilton Post Office.

POWER & SON, architects, Kingston, Ont., are preparing plans for a new elevator for Richardson Bros., Kingston.

AN acetylene gas company is to be established in Carleton Place, Ont., and has already asked for street privileges.

THE Goldie & McCulloch Co., Galt, Ont., recently shipped a large boiler to the Ontario Rolling Mills Co., Hamilton.

THE Methodists of Brandon, Man., will build a $30,000 church next season S A. Bedford is chairman of the building committee.

HARLAND BROS, Clinton, Ont, hardware, are putting in a 40-light acetylene machine and will furnish some neighboring firms with light.

THE Waterloo, Que, waterworks, owned by Gould & Wilson, will shortly pass into the possession of the municipality, which gives in the neighborhood of $21,000 for them

Two carloads of screens from the Jenckes Machine Co., Sherbrooke, were received at the mills of the Chicoutimi Pulp Co recently, and are now being set in place.

THE Montreal City Bill, now before the Quebec Legislature, proposes to give the city the right to borrow $250,000 for the extension and improvement of Bonsecours market.

THE Canadian Typograph Co, manufacturers of the well-known E & D. bicycles, have received orders for 150 of their wheels from South Africa, nearly 100 of which have already been shipped.

FOUR municipal by-laws were voted on in Galt, Ont, Jan. 3rd, all of which were defeated, viz $7,000 for market extension, $8,000 for new fire hall; $3,000 for hospital sewer, $1,800 for electric fire alarm.

THE Windsor, N S. Plaster Co. commenced grinding plaster early in December, and is now able to supply the celebrated Selenic Cement. This is the first manufactory in Windsor to begin work after the fire.

THE plant of the Phelps Machine Co, Eastman, Que, has been bought out by the Jenckes Machine Co., of Sherbrooke, which will continue the manufacture of the Dake engine in the Sherbrooke works.

THE City of Belleville, Ont, owns its gas works The original investment was $14 400 The dividends in twenty years have amounted to $28 224 in addition to two per cent. which has been put aside each year for repairs and improvements.

R MACKIE has been appointed engineer of the new sewage disposal works, Hamilton, Ont, at a salary of $600. Mr. Mackie holds a first-class certificate, and has been engineer at the Hamilton Bridge Co., the Copp Bros., Limited, and the Rolling Mills.

AT the annual shareholders' meeting of the Dominion Wire Manufacturing Co., Montreal, the following directors were elected by the shareholders James Cooper, president; C. W. Vollmann, vice-president; J C McCormick managing director; F W. Fairman, H. Horsfall.

AT the annual meeting of the Montreal Metal and Hardware Association the following officers were elected President, George E. Drummond; vice-president, J B Learmont; treasurer, J W. Pyke; directors, Charles Cassills, Frank Caverhill, Robt. Gardner, and C. L. Letang A resolution was passed endorsing the limitation of credit to four months and 3 per cent for cash.

WATER was let into the penstock at the pulp mills at Chicoutimi on the 15th ult The mill, it is expected, will be in full operation by the 20th The development of the water power in connection with the mill was undertaken by the Jenckes Machine Co., of Sherbrooke, Que., which used four special Crocker wheels for the purpose. The wheels give excellent satisfaction under the usual head of 70 feet.

DR. C. J. EDGAR, North Hatley, Que, has formed a partnership with W O. Roy, of Montreal, and acquired a water power on the Massawippi River, a little below the village. They will furnish electric lights and power to North Hatley, Eustis and Waterville. A contract has been made with the Jenckes Machine Co., Sherbrooke, Que., for developing the power, and the whole plant will be put in at once.

J. P. CARRITTE, St. John, N.B., and J. W. Patterson, of the Patterson Manufacturing Company, Montreal, have contracted with the People's Heat and Light Company, Halifax, N.S, for the company's tar output, and will have erected as soon as possible a factory on the North-West Arm, for the manufacture of tarred roofing and building paper, and all bi-products of tar. They have bought plant in New York, and plans have been prepared for the buildings. The works will be ready for operation in the latter part of February, it is expected.

YARMOUTH, N.S., will build a $15,000 school.

THE reservoir of the Parrsboro, N.S., waterworks has been completed.

E D SMITH, Winona, Ont., fruit grower, is spending $5,000 on a cold storage warehouse.

THE Detroit Lubricator Co. has recently received orders for 100 locomotive lubricators, which are to be shipped to China and Japan.

MADISON WILLIAMS, who is now proprietor of the foundry and machine shop of the Paxton, Tate & Co. estate, Port Perry, Ont., is doing a good business.

THE new pulp mills of the Royal Paper Mills Co. at East Angus, Que, are rapidly nearing completion. The contract for the entire tank work has been awarded to the Jenckes Machine Co., Sherbrooke, Que.

THE Rev. D. B Marsh, Black Heath, Ont., inventor of the Marsh stethophone, is now taking out patents in the United States and several European countries. Mr. Marsh has made a number of improvements on the instrument since the patent first issued in Canada

THE trouble between the Customs Department and the Canadian agents of the La France Engine Company has been settled by the payment of $441 additional duty and fine. The company, in a letter, gave the lowest price of the engine as $4,200. When it reached Canada it was entered at $3,570, that is 15 per cent. less than $4,200, This $630 was understood to have been the Canadian agents' commission at 15 per cent The Customs authorities have now decided that the correct value for duty was $4 350, and has collected 35 per cent on this $630 deducted, with a fine of 100 per cent on the amount of undervaluation.

SINCE the publication of the article on towns' water supply in our June number, which points out the poisonous effects of lead pipe on drinking water, we have received from E. Walker & Co., water pipe manufacturers, Heckmondwike, Yorkshire, England, a sample of their wrought iron pipe lined to a thickness of over one-sixteenth of an inch with block tin, and a suitable connecting coupling lined so that the water cannot possibly come in contact with the iron, even at the joinings They also make iron pipe with a non-conducting material or insulator placed between the iron pipe and the block tin lining, which they claim prevents frost penetrating the pipe and freezing the water. This overcomes the difficulty pointed out, and supplies a pipe almost everlasting in wear, and that cannot rust, or in any way destroy the purity of the water The sample can be seen at the office of THE CANADIAN ENGINEER

J O LA FOREST, superintendent of the Montreal waterworks, has again called the attention of the city council to the danger that will attend further neglect of the long-needed waterworks extensions. The high level reservoir contains about 1,750,000 gallons, or less than 24 hours' supply for the district it serves; while the only engine capable of duty at the McTavish street station is worked beyond its capacity, so that there is no time for overhauling in case of accident. The water supplied from the high level reservoir has increased enormously in recent years. In 1885 it was 48 986,086 gallons, while in 1896 it had risen to 662,572,822 gallons. A new engine is urgently needed at a cost of about $40,000, including erection, and an additional boiler at a cost of $19,650, including alterations to the buildings. The cost of connecting the two sections of the reservoirs to the suction pipe, and the continuation of the 20-inch main to the high level reservoir, will add about $10 000 more to the cost of the needed improvements.