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The Canadian Engineer

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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.

CHAPTER III.

CURVES—(*continued*).

ARTICLE 8—VERTICAL CURVES.

Wherever there is a change in the rate of grade there must be a vertical angle or a vertical curve. If this change is slight, less, say, than $\frac{3}{10}$ feet per 100 feet, no need exists, either on construction or afterwards, of doing anything more than to let the trackmen put in a slight curve by eye, but when the change is of considerable magnitude, care should be taken, both for the sake of appearance and also for safety, that a regular vertical curve unites the two grade lines.

In the past, in America, this has not been often done. If ascending and descending grades were to be united, a short piece of level grade was inserted at the summits and in the depressions; anything further was, curiously enough, relegated to the track gang as being a refinement unnecessary for a civil engineer to bother with; the track or section foreman, with greater appreciation of the real need for a regular increment of change from one grade to another, did the best he could and put in vertical curves by eye, which moderated the ill-effects of such neglect. Wellington has ably dealt with the subject, at length, from the standpoint of the link-and-pin coupler, and demonstrates that the vertical curve which is needed, theoretically, is one which will change the rate of grade from the front to the rear of the longest trains run over the road by an amount not greater than the grade of repose (the grade of repose is that grade down which a train will just keep moving under its own weight, and is about $\frac{5}{10}$ per cent. for loaded trains at a speed of 25 miles per hour, and increases with the speed). He reasons thus: Taking the train as a whole, each car will momentarily crowd toward the one in front of it, and so on throughout the whole length of the train, putting it in a state of compression, with slackened couplers if the grade resistance at the front of the train is enough greater than at the back end to exceed the grade of repose. This is based on an assumption of uniform engine power, and should the engine driver increase speed just at this instant, when everything is slack, the tendency will be to create severe jerks and oscillations causing derailments. This reasoning refers entirely to a grade depression, whereas at a summit the reverse will happen and the couplers will be momentarily strained much more than normally. From these premises we can see that the vertical curve at summits may be arbitrary in amount and much sharper than in depressions. Probably a change in rate of grade of $\frac{2}{10}$ per cent. for each 100 feet is not excessive, and may be inserted either as a complete curve joining the ascending and descending grades (see Fig. 8), or if the summit level is long it may be divided into two portions (see Fig. 9). When, however, a descending grade is to be

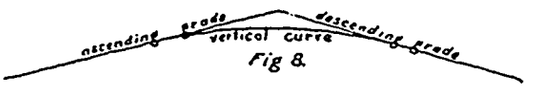


Fig 8.

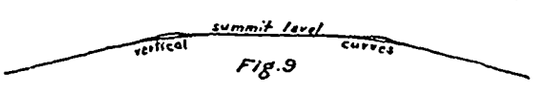


Fig. 9

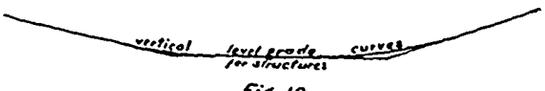


Fig. 10.

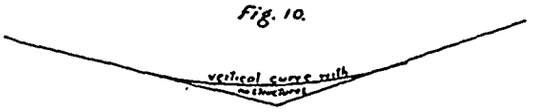


Fig. 11.

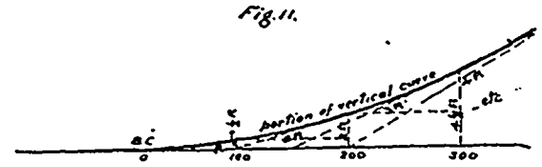


Fig. 12.

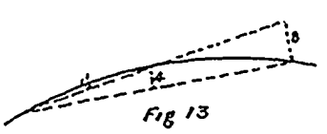


Fig 13

united to a level or ascending grade, an accurate calculation should be made for reasons already given. For in-

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

stance, supposing that the longest train on the road will be 500 feet (engine and 14 cars), then

$$\frac{\frac{5}{10}\text{ per cent.} \times 100}{500} = \frac{1}{10}\text{ per cent. change}$$

per 100 feet will be the amount strictly demanded for complete safety on a road of the given length of train using link and pin couplers. But as automatic vertical plane couplers, with practically no slack, come more generally into use, which is only a question of a few years, the need for such extensive curves will not be imperative, and a vertical curve changing more rapidly will answer fully, when a longer curve is difficult to obtain. Usually, however, a level grade between the descending and ascending grades is required, because a structure should always be placed on a uniform grade from end to end, and as they are usually in the depressions, this limits the vertical curve in such cases to two short pieces joining the level grade to the others. (See Fig. 10.) If there is no break in the embankment a continuous vertical curve is much better from every point of view, and should be put in as in Fig. 11.

On roads having only light grades, and consequently heavier and longer trains, the rate of change in depressions will be very small, and circumstances will determine whether the full amount can be put in without excessive cost; but with light grades and easy vertical curves, the distance which the middle of the curve will rise above the point of intersection is small. It may be calculated, in any case, in the same manner as the middle distance in horizontal circular curves, if the vertical curve is treated as a circle, or if treated more precisely as a parabola, it may be stated at once as half the distance which the apex is from the middle of a cord drawn from one end of the vertical curve to the other, this being a fundamental equation of the parabola.

(*a*) Treating the vertical curve as an arc of a circle, calculate first the permissible change in grade per 100 feet divide this into the total change of grade, giving the total length of curve, $\frac{1}{2}$ of which will be on each side of the apex of grades; then the position of the curve for each 100 feet relatively to the tangent lines may be obtained graphically on a large scaled drawing, or calculated more precisely as in ordinary horizontal circular curves.

(*b*) Treating the vertical curve as a parabola having a constant rate of change of direction per 100 feet, is more precise and more convenient. Calculate first the length of curve, which will be the same as in (*a*), and then proceed as follows: Let the change of grade per 100 feet = R. Then referring to figure 12—, the departure of the curve from the tangent will be $\frac{1}{2}$R, 2R, 4$\frac{1}{2}$R, 8R, 12$\frac{1}{2}$R, ... etc., till the middle of the curve is reached, after which the distances from the second tangent will recede . . . . 12$\frac{1}{2}$R, 8R, 4$\frac{1}{2}$R, 2R, $\frac{1}{2}$R, to the other end. It will be seen that by the latter method the elevations are always in even units or portions of units, and the rise of the curve above the tangents is given almost by inspection; for convenience the length of a vertical curve should be fixed at the nearest *even* hundred feet, so that the curve may be divided into two equal parts of exact hundreds in length. Such vertical curves, with their elevations once established, will be no more difficult to place on the ground and build to than a succession of straight lines with abrupt changes in grade, and will give a track safer in depressions, having better drainage in summit cuts, and better in every respect, but increasing the cost of the road-bed slightly.

Art. 9.—Horizontal Circular Curves.

It is not necessary to treat here of the mathematics of the circle. There are several engineering field books which have considerable space devoted to methods of placing curves on the ground under ordinary or exceptional circumstances. Some of these books also contain, in addition to ordinary mathematical tables, tables of external secants and of sub-tangents for each degree of curve, and for each interval of one minute in the total intersection angle; these books are great time-savers in field operations, and should always be used.

In placing curves on the ground, it is preferable to establish the two tangents first, intersect them and measure in the BC and EC from the intersection or apex; ther the curve can be run in from either or both ends and any error minimized. With very long flat curves on unstable ground, it may even be preferable to fix the middle of curve from the apex by measuring in the external secant, and then run the curve in from the ends and middle; the method sometimes adopted of running a curve in from the BC, and deflecting on to the second tangent at the EC, is very liable to establish it erroneously.

Another very important point is the method of keeping curve notes. The vernier should always read half of the total deflection of the curve from the BC up to the point on the curve toward which the telescope is pointing; this is a constant index of the position of any point. This method necessitates loosening the vernier-plate at each set-up and re-setting it to read the index reading of the back-sight; but it has the all important feature of enabling a transit to be set up at any point on a curve, and being sighted to any other point with a certain knowledge of what the vernier reading should be. Curves can be run in backward as easily as forward. Any other method of keeping notes will be found, in the end, less reliable and convenient. Whenever curves are sharper than 4° or 5° it is better to put in stakes every 50 feet even on easy ground, as the difference between the length of chord and curve for 100 feet measurements would be considerable; it is also convenient for cross-sectioning. In running in sharp curves, particularly curves having a large intersection angle, the greatest care is necessary in the chaining; poor results in checking up at the EC are usually traceable to the errors in measuring the subtangents or the curve itself.

It is often necessary to replace stakes that have been lost, or to put in intermediate stakes on curves without the aid of a transit; whenever this is the case it is valuable to remember the following formula, which is approximately true for all curves usually used on steam railways:

It is $O = .218\ N^2D$ ....(11)

Where O = offset from middle of a chord to the curve (in feet)

N = length of chord in 100 feet.

D = degree of curve.

Or, if simpler, remember that the offset from the middle of a 100-feet chord on a 1° curve is .22 feet, and that

(1) Offsets vary directly as the degree of curve.

(2) Offsets vary as the square of the length of chord, which is true up to 200 or 300 feet chords.

(3) Offsets, inward to a curve, from a prolonged chord are 8 times the offsets from the middle of the same length of chord outward to the same curve. This is illustrated in Fig. 13.

Circular curves are in general use on railways, but there have been isolated attempts at using the parabola, which have not been found satisfactory. The idea involved in its use was to have a curve of easy radius at the ends and sharper in the middle, but the train did not travel steadily, being in a constant state of change from beginning to end of curve. It has been found from the very

first days of railroads that an annoying and dangerous jolt, sidewise, took place as a train either entered or left a curve, and the parabola was a first or rather a mistaken idea as to remedying this evil.

Instead of this, the concensus of opinion has fixed itself on the use of the circular curve, but with the modification of the use of easement curves at each end of it to join it on to the tangents in such a manner as to modify or wholly dissipate any disagreeable shock which would occur if the curve were to change instantaneously to a straight line. In the past the trackmen have been allowed to introduce these easements themselves in an approximate and makeshift manner, but at present there is a growing feeling that an accurately calculated and placed easement curve is necessary, especially as passenger speeds are becoming higher. Easement curves have been used for many years in Europe, and are becoming quite common in America.

CONDENSERS.*

BY E. J. PHILIP, TORONTO.

The condenser may be said to have the inverse relation to the steam that the boiler has, for as the boiler raises the temperature of the water and increases its volume, the condenser reduces the temperature and volume. The boiler converts the water into steam, and the condenser reconverts the steam into water. The advantage of running condensing instead of exhausting against the pressure of the atmosphere is explained by reference to the principle by which the maximum efficiency of heat engines is calculated. For example, suppose two engines exactly alike and each driving the same load, each working with steam of say 60 lbs. pressure absolute, one working with a condenser and the other exhausting into the air, suppose one engine expands down to 3 lbs. absolute, the other to 2 lbs. above atmosphere or 17 lbs. absolute, the relative efficiency of the two engines may be expressed as follows: The temperature of steam at 60 lbs. absolute is 292.7, that of steam at 17 lbs. absolute is 219, and of 3 lbs. 141.5.

$$\frac{292.7 - 141.5}{461 + 292.7} = \frac{151.2}{753.7}$$

while that of the non-condensing engine is

$$\frac{292.7 - 219}{461 + 292.7} = \frac{73.7}{753.7}$$

or in the ratio of 73.7 to 151.2, or as 18 is to 37. From a mechanical point of view the advantages are more apparent as illustrated by an indicator diagram, for it enables us to reduce the back pressure from, say 2 lbs. above to 12 lbs. below the temperature of the atmosphere.

Condensing allows us to make use of much higher grades of expansion than is possible by non-condensing. The condenser itself is an apparatus into which the steam is discharged when it has done its work, where it comes into contact with a jet of water, or else with a large surface one side of which is kept cool by contact with water. The steam entering the condenser is instantly condensed, giving up its heat to the water. The result would be a practically perfect vacuum only for the fact that the feed water contains air which the steam gives up during condensation, and causes a back pressure on the piston. An air pump is attached to a condenser to pump out the air and the water of condensation, and in the jet condenser it has also to pump out the injection water and the air it contains.

There are many forms of the different types of condensers. The best known type is the jet condenser, once used almost universally when pressures did not exceed 35 pounds. It consists essentially of an air tight chamber into which the exhaust steam passes from the cylinder after having done its work. It is met on entering by a jet of water caused by the inrush of water through holes or slits in the pipe placed across the opening, or by many other spraying contrivances. If the water enters through holes in a shower, it mixes mechanically with the steam; if it enters through slits, it causes the water to enter like broad, thin sheets, and the cooling is done principally by surface contacts. In either case the result is the same: the turning of the steam into water, and it falls to the bottom of the condenser and is pumped out by the air pump.

It might be supposed that the mere turning of the steam into water, thereby causing it to occupy less space, will cause the vacuum. It does, but to so slight an extent that unless some other means to maintain it were provided the condenser would be useless, for the reason that water readily absorbs air when exposed to it, and gives it up again on being boiled. The feed water contains air, which becomes mechanically mixed with the steam in the boiler, and passes with it through the engine to the condenser, where it is freed from it when the steam is condensed, and remains as cool air. In the jet condenser the cooling water also contains air, and under the partial vacuum and the temperature of the exhaust steam it readily gives some of it up. The engine has only to make a few strokes without the air pump, when the air will have accumulated so as to raise the pressure to that of the atmosphere, and although the condenser may be kept cool there will be no vacuum. Now the water that has accumulated from the steam being condensed, might be arranged to run away by gravity; it is only the air that is of necessity pumped out, and hence the pump, although pumping both air and water, is rightly named the air-pump. The jet condenser has been made in many different shapes. The essential feature is that the inlet for the steam prevents the water running back to the engine, in case of flooding. A good arrangement for mixing the steam and water is to have the bottom so formed that the water will all drain into the air pump. Condensers are made to suit the various conditions and positions. In marine work they are made to suit the relative positions of engine and hull, and was often a part of the engine frame.

The columns of vertical engines were used for this purpose until the practice was forbidden by the Admiralty, but they are so used in some cases yet. The capacity of the jet condenser is usually one-third the capacity of the engine, and should not be less than one-fourth or more than one-half. The objection to a large one is, besides its extra weight and first cost, the longer time required to form a good vacuum. The objection to a small one is the liability of flooding. The quantity of injection water varies, and it depends on the temperature of the steam and its weight, also the temperature of the injection water and the water in the hot well.

The feed water is usually taken from the hot well, and there is an advantage in having it as hot as possible without impairing the vacuum. Therefore there should be just sufficient injection water used to cool the steam down to the required point to get a good vacuum with a jet condenser; 24 inches is a good vacuum; 25 inches is the most economical point. The temperature due to 24 inches vacuum is 140°. In actual practice the temperature of the hot well varies from 110° to 120°, but it can be got up to 130° with great care. To calculate the quantity of injection water per pound of steam to be condensed, let T be the total heat of the steam; let T be the temperature

*A paper read before the C.A.S.E. convention at Brockville.

of the cooling water and t the temperature of the hot well, and Q the quantity of cooling water per pound of water in the steam.

Then $Q = \frac{T - t}{t - T_1}$ This is the number of lbs. of cooling water for each lb. of water in the steam. Example: Find the amount of injection water required. Exhaust 19½ lbs. injection water, 60; hot well, 110:

$$\frac{1182.1 - 110}{110 - 60} = 21.44, \text{ or } \frac{1114 + .3 \times 227 - 110}{110 - 60} = 21.44.$$

Pressure began to rise above 35 lbs.; the jet condenser was abandoned, and the surface condenser began to take its place. One of the principal causes was on account of the feed water carrying so much salt, which, as the water in the boiler was evaporated, became so saturated as to be eventually deposited on the plates, and thus destroy the boiler. The only way to avoid this was to blow off some of the brine and feed in some with less salt. The hot water blown away caused a large loss of heat, varying according to the different degrees of saturation. The maximum density is three times that of sea water. The loss was generally from 12 to 15 per cent. of the fuel supply. In order to stop this loss it became necessary to feed the boilers with fresh water. This could only be done by keeping the steam and condensing water separated, and this led to the surface condenser. Another reason was that in order to effect any considerable economy in the engine, it became necessary to raise the steam pressure. Now if the pressure be raised above 35 lbs., the temperature of which is 280, the sulphate of lime in the sea water is deposited in hard insoluble layers on the heating surface, and destroys its efficiency. To obviate this, it became necessary to use fresh water, which was another reason for the surface condenser.

The amount of water required with a surface condenser is from 30 to 40 per cent. greater than with a jet condenser. *In experiment, it was found that sheet copper* backed by water condensed from 21 to 50 lbs., and under special conditions 100 lbs. per square foot per hour. It is usual, however, to allow only 12 to 13 lbs. per square foot per hour, for ordinary compound engines. In a surface condenser, the circulating water must be kept in constant circulation to realize the greatest efficiency by keeping up as great a difference of temperature between the two sides of the plates. The air pump, with the surface condenser, is much smaller than with the jet; but the condenser is much larger, neavier and more costly than the jet.

The amount of cooling surface allowed per h.-p. varies from 1¾ to 3 square feet, but is usually 2 or 2½. The surface used is now always brass tubing. In former times copper tubing was used, as it was such a good conductor of heat, and had the qualities to resist the varying strains and temperatures, and it could be drawn out very thin; but it was found that the acids from the fatty matter used in cylinders dissolved some of the copper, and formed soluble copper salts which was fed into the boilers with the feed water, and did great damage to the boiler. This gave the surface condenser a set back, as the saving was offset by the extra wear and tear on the boilers. To prevent this, the tubes were coated with tin inside and out, and this partly prevented the trouble, but not altogether. Brass tubes were tried, and after getting the proper mixture proved a perfect success. Much has been said about the corrosive action of distilled water; but most of the trouble from pitting and corrosion in boilers and their fittings using distilled water has been found to be the action of the water on something else, and the matter formed is what does the damage to the boiler.

Before closing with condensers, I will say a few words about the necessary complement of the condenser, the air pump, of which there are different types. The most efficient, the writer believes, is the single acting vertical pump, having valves in the bucket, as well as foot and delivery valves. This is a very familiar form of pump. Another is the double acting, made both vertical and horizontal, having a piston with foot and delivery valves at each end. In most of the stationary plants the air pump is of this type and driven by an independent steam cylinder. This is a good arrangement, as a vacuum can be produced before starting the main engine. The disadvantage is, it is the most wasteful way of operating the pump. In marine engines the pump is usually driven from the cross-head and is generally single acting. The advantage of this arrangement is the pump is driven at least expense for power. The efficiency of the single acting pump is due to its certainty of taking the water through the bucket valves, and to the certainty of the valves closing, due to their position; also the valves are always flooded with water and the clearage may be reduced to a minimum.

The size of the air pump can be calculated theoretically, and it has been found that the single-acting pump, working under favorable conditions, has an efficiency of .6 and varies to .4. The efficiency of the double-acting pump may be taken as from .5 to .3. The size may be taken as three times what theory demands. With a surface condenser there is also a circulating pump to circulate the water through the tubes. In stationary work, the pumps are arranged with the steam cylinder in the middle, with the air-pump at one end and circulating pump at the other, all on one rod. In marine work some use an independent pump, either an ordinary double-acting plunger or a centrifugal pump. Others use a single or double-acting pump driven from the main engine. The capacity of the circulating pump may be calculated the same way as the air-pump. The centrifugal pump has many advantages as a circulating pump, if the lift is not great. It has no valves to interfere with the flow of water or get out of order. Being worked by a separate engine, it can be started before the main engine, and keeps the condenser cool while warming up. Having an independent engine, the quantity of water may be varied to suit conditions, the power to run it varying in proportion. The supply of water is continuous, thereby avoiding all shock to the condenser and piping, and its efficiency is greater for low lifts than any reciprocating pump.

Another type of condenser I will just mention is the ejector condenser, which is perfectly satisfactory under certain conditions. The principle on which it works is the same as the ejector, but the water should have a small head to make it work satisfactorily when as good a vacuum can be maintained as with any other type. The water should not be over 60°, although it has been used at a higher temperature. The rise in temperature is usually about 20 or 25°, but in experiments it has been raised 60 to 64 with a final temperature of 120°, but under these conditions the vacuum fell considerably. In this type the power to run the air pump is saved; these condensers have also been made to lift their own water, but under these conditions they are unreliable.

THE Carlisle Packing Company, Victoria, B.C., is now exporting canned salmon in tin cans which have a porcelain lining. If these cans can be produced at a reasonable price, their use should enormously extend the Canadian trade in canned fish, fruits, etc., as in this way the goods could be indefinitely preserved without danger of becoming poisoned by the corrosion of the can.

For THE CANADIAN ENGINEER.

THE MINERALS OF NEWFOUNDLAND.

BY AN OLD RESIDENT OF ST. JOHN'S.

Newfoundland as a field for legitimate mining, which, with intelligent management and moderate capital, would return handsome dividends, seems to have been hitherto almost entirely overlooked. In the December issue of THE CANADIAN ENGINEER, 1895, there were notes from the pen of the late Geo. Spotswood, C.E., on the petroleum fields which he had then partially examined, and of which a few months prior to his death he had been in charge, and had successfully developed. Unfortunately this was at the cost of a valuable life. Anxiety and exposure in getting the first well completed and the second started hastened the course of a disease he had contracted, and which resulted fatally in November, 1896.

The geology of the field as determined from his partial examination is shown in the report to the company which is operating the claim located by him in October, 1894: "The geological formation belongs to the Quebec group—consisting of limestone, limestone conglomerates, shales and sandstones, with dips from 30° to 80° and strikes varying from 220° to 250°."

An analysis of the crude oil was made by J. T. Donald, of Montreal, on September 27, 1894, and was as follows:—

Specific gravity	.885, or 28 B.	Burning oil..	14.50 per cent.
Water	traces.	Heavy or lub.	82.50 "
Gasoline	none.	Solid res	3.00 "
Naphtha	"	Sulphur	.098

This analysis was made from crude oil gathered from the surface depressions; when the wells were sunk it was found that the oil at 1,000 feet was much lighter, and gave a higher percentage of illuminating oil, as shown by the following report of Rufus Merrill, who refined a sample of the crude.

"Color, dark olive green; gravity, 36° B. at 60° F. Odor, aromatic. Yielded by destructive distillation.

Naphtha	7	per cent.
Ill. Oil	56	"
Lub. Oil	34	"
Coke	3	"
	100	"

"This oil belongs to the aromatic petroleums and is of the paraffine series; the products of distillation are of bland and pleasant odor, easily refined, and yield more readily to and require less acid and alkali than any of the oils found in the United States. The illuminating oils are high fire test water white, and burn with a clear lambent flame of great brilliancy and less tendency to smoke than the best United States oils. The crude oil is very free from grit and foreign substances, and with proper reduction would make a first class natural lubricant; finally, there is no known field which to-day produces an oil of equal quality."

The territory appears to cover about 250 square miles, but beyond the wells sunk by the Newfoundland Oil Company, which are producing, and one ten miles further north, there is no development. An English company is negotiating for the Newfoundland Oil Company's property, but whether they will finally close the deal cannot be stated; it is to be hoped that either an English or Canadian company will secure the territory, and not let the United States refiners step in, as usual, and gather the financial honey which our people should get. If the Newfoundland Oil Company does not sell it will probably refine the oil on the spot, and ship to England; they are on the seaboard, and 6½ to 10 miles of pipe will put the product of the wells at tide-water.

Asbestos properties on the west coast must very soon be a factor in the asbestos market. On a claim which the writer knows there is an inexhaustible quantity of low-grade and a very large quantity of high grade ore, which can be mined and sold, on account of the favorable situation, for very little more than it costs to mine in Quebec. I am aware that the Quebec miners are sceptical about the asbestos in Newfoundland, but some day they will have an object lesson that will open their eyes to the facts in this case.

The minerals, etc., so far found in Newfoundland, in economic—and probably economic—quantities, are gold, silver, lead, iron (both magnetic and hematite), coal, copper, nickel, asbestos, gypsum (no deposit in any known country so large), marbles of the most beautiful kinds, chromic iron, manganese, and molybdenum.

Mining in that country has suffered from two things—ignorant and most unskillful management and over capitalization, for both of which the English operators are principally to blame.

THE INDICATOR.*

BY G. B. RISLER, LONDON, ONT.

The indicator is an indispensable assistant to the engineer, and of late years it has become evident that intelligent and wideawake steam plant owners recognize the necessity for such a valuable instrument, and they are also appreciating the services of the engineer who is competent to use it properly.

The indicator diagram is actually the only means of showing on paper what really takes place in a cylinder. To read an indicator card correctly is not an easy matter, and in order to be able to do so, considerable study and practice are necessary. The handling of such a delicate instrument requires a great deal of care, and sometimes considerable skill and ingenuity must be employed in making the needed attachments. By its use many stumbling-blocks will be removed, while the calculations and geometrical work which the engineer will be impelled to make in connection with it will lead to the acquisition of a good general knowledge of the whole subject. Careful consideration of the diagrams from different engines, under varied conditions, cannot fail to lead to thought and investigation. A general knowledge of the law of gases (especially Mariotte's law) is needed, and a study of physics, mensuration and mechanics is most beneficial.

In order to determine the most economical plan of operating a steam plant, many tests are made. Such tests, if properly conducted, are valuable, and are much to be appreciated by steam plant owners, who will find it to their interest to give every encouragement and assistance to the engineer along this line. The diagrams traced by the indicator pencil will vary widely, and depend on the condition of the different engines from which they are taken, and it therefore becomes necessary to know how to interpret these variations correctly. This information the engineer can only acquire through the processes of reasoning and hard study. In attaching the indicator considerable skill is sometimes needed, and circumstances must determine what plan can best be employed. The reducing motion must be such that it will give to the paper barrel in its reduced scale an exact reproduction of the movement of the piston.

Examine your indicator, and see that every part of it is moving freely, has no lost motion, and is well oiled. A

*A paper read before the Canadian Association of Stationary Engineers' Annual Convention, Brockville.

cord that will stretch is to be avoided. Good judgment is required in putting the proper tension on the paper barrel spring for differently speeded engines. The indicator springs should be tested occasionally to see if they agree with a standard steam gauge of known accuracy. Do not use too light a spring for the pressure. If the instrument is a reliable one, and the necessary precautions have been taken in every particular, the diagram will then show you the pressure acting on the piston on both sides, and at any part of the stroke during one revolution of the engine, and that is all it will do. Knowing the scale of the spring, it is an easy matter to determine the pressure at any point of the stroke. This little tell-tale instrument will leave on a piece of paper a good deal of information, providing the atmospheric pressure line is properly established on the diagram. It is of the greatest importance that this line be drawn correctly, as it is the neutral line of the diagram, and from it all pressures above and below must be determined. After removing the card from the paper barrel, it is advisable that all data be made on it as complete as possible, and then will its study be pleasant and profitable.

The following terms are used in speaking of the different lines and curves: The atmospheric line, vacuum line, admission line, steam line, exhaust line, counter pressure line, compression and expansion curve. The beginning and termination of some of these lines are called points, and their continuation indicates periods in the stroke of the piston. Technical terms for pressure are as follows: Boiler pressure, absolute pressure, initial pressure, cut-off pressure, terminal pressure, back pressure, and mean effective pressure. The mean effective pressure is what we must find in order to calculate the indicated horse-power of the engine, and the indicator card is the only means of getting it correctly.

Having once established the mean effective pressure from the diagram, the work done in one stroke, in foot pounds, can be calculated as follows: Multiply 144 by the mean effective pressure, and by the cylinder volume in cubic feet, displaced by the piston. Two simple and easily remembered rules for finding the indicated horse-power when the mean effective pressure is known, are as follows: 1. Multiply the mean effective pressure by the cylinder area in square inches and by the piston speed in feet per minute, and divide by 33,000. 2. Multiply the mean effective pressure by the length of the stroke in feet, by the area of the cylinder in square inches, and the number of strokes per minute, and this, divided by 33,000, will equal the indicated horse-power. From the foregoing it can easily be seen that the indicator is invaluable in determining the work done by an engine.

But this is not all, by any means. An analysis of the expansion curve, which requires considerable knowledge and accurate working from a geometrical and arithmetical standpoint, is of great value, and the nearer the actual expansion curve of the diagram approaches the theoretical (often called the equilateral hyperbola), the greater will be the economy. A considerable deviation from the actual and the hyperbolic curve impels the engineer to think and to reason out the cause. A leaky piston, a leaky steam valve, re-evaporation in a cylinder, or a leaky exhaust valve—all these tend to bring about an expansion curve, which is not in accordance with the law of gases laid down by Mariotte, viz., that the volume should vary inversely as the pressure. This, of course, is to some extent an impossibility in an engine cylinder, owing to loss of heat and leakage. Nevertheless, diagrams have been taken from steam engines which are a credit to the engineer, as well as to the engine builder, and are almost identical in the expansion curve to the hyperbola. It is not advisable to come to hasty conclusions in regard to the expansion and compression curve, as well as other lines, because the laws of nature can have quite an influence in this respect, owing to the surroundings and conditions under which a steam engine may be working. The engineer well knows that dry steam should be furnished to an engine; therefore, it is reasonable to state that the steam boiler at times can be held responsible for a diagram which does not approach the ideal. If the steam pipe leading to the boiler is too small in diameter, the indicator diagram will give an indication of it, but this should be verified with the diagrams taken direct from the steam chest or the steam pipe. The indicator card will furnish the means of knowing how the steam is distributed in the cylinder. If the valve gear is not properly working the card will show it. With calculations from the diagram we can find with what sort of economy, mechanically and thermodynamically, the engine is working, and if underloaded or overloaded the engineer will be in a position to advise his employer exactly what changes should be made in order to insure greater economy in fuel. The steam line may show considerable initial expansion or loss of boiler pressure, and the back pressure line can point out excessive resistance to the piston. Both cases are evidence of wasteful expenditure of steam.

Economy to the engineer means keeping down the fuel account, having small bills for repairs, little or no loss from shut-downs, regular speed, and the least possible loss from deterioration. The engineer must be guided by circumstances, and if he finds himself confronted with conditions that render the attaining of strict economy impossible, he then can only make the best of bad surroundings. Steam engine economy is made up of many factors, and it is to be hoped that the endless study and exertion on the part of the intelligent and ambitious engineer will be appreciated by the employer.

It is my belief that many steam plant owners or managers are willing to assist the engineer financially in obtaining such an instrument as the indicator, as well as other most valuable appliances which would serve as aids in many instances to the greatest economy.

My employers, The *Advertiser* Printing and Publishing Company, of London, have recognized the wisdom of this, and assisted me to the extent of $50 in purchasing an indicator in 1893, and also obtaining for me in 1896 a free engineer's scholarship with the International Correspondence Schools in Scranton, Pa.

For THE CANADIAN ENGINEER.

COMPOUND, DIAGONAL PADDLE ENGINES.

On page 127 is shown the side elevation and plan of the engines of the steel paddle steamer being built by the Polson Iron Works, of Toronto, for the Pembroke Navigation Co., from the designs of Arch. P. Rankin, consulting engineer, of Toronto.

The hull, which is of steel throughout, is 125 feet long, 21 feet beam, 7 feet 6 inches deep, and 4 feet 9 inches draught, and the estimated speed is 14 miles per hour.

The engines are of the compound, direct-acting, diagonal type, which has of late years become very popular for paddle steamers, its chief advantages among others being that the weight is better distributed along the keel, and the stresses set up by its action are chiefly in a fore and aft, and downward direction, and therefore easily resisted by the natural structure of the vessel. Moreover, with this class of engine the chief working parts are in full view of the engineer from the starting

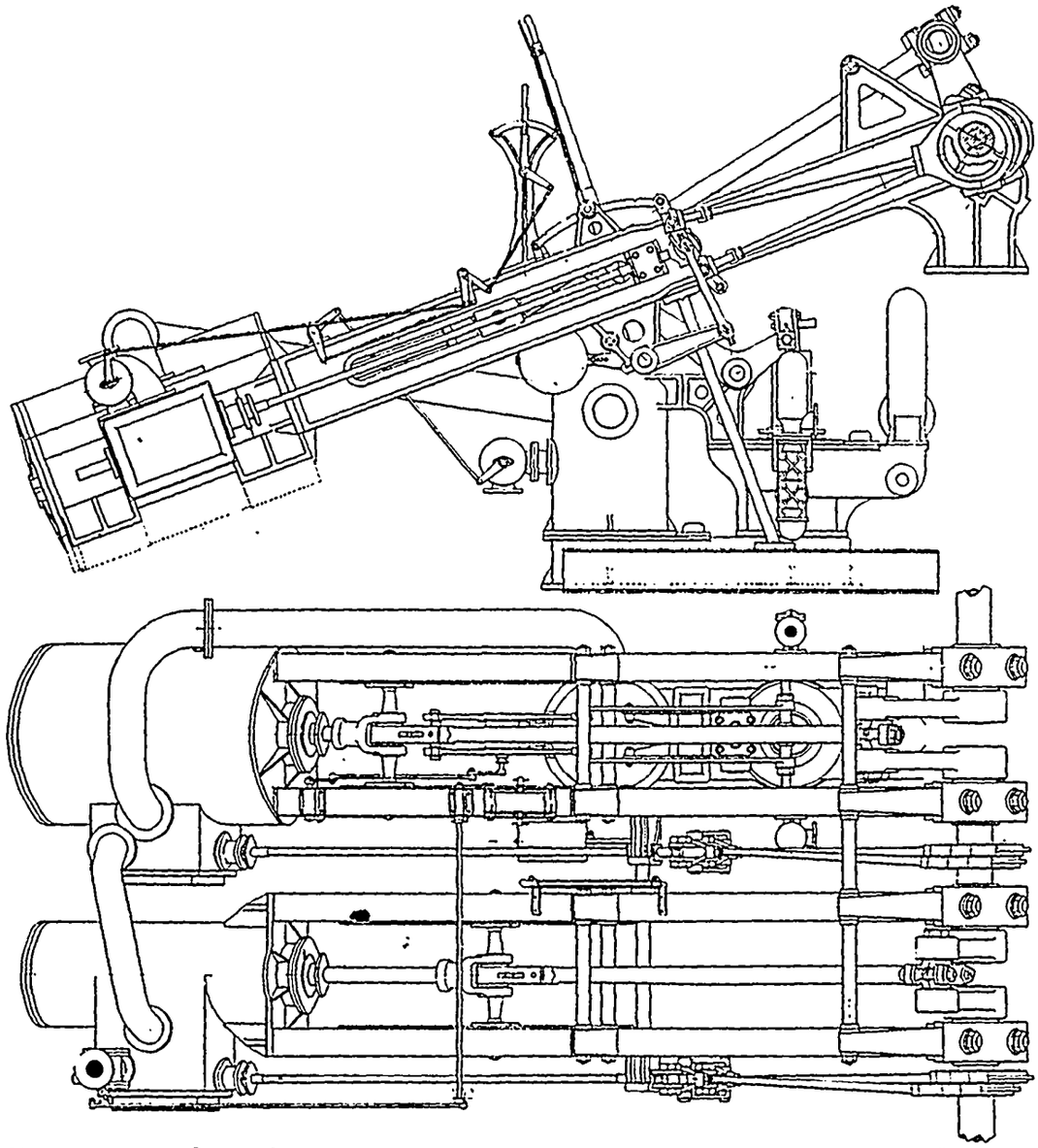
platform, and are easily got at for adjustment and repairs.

The high and low pressure are respectively 17 inches and 34 inches diameter, with a piston stroke of 48 inches, connected to each other only by the exhaust pipe. Both cylinders are supported on a diagonal stool built of steel plate and angles, riveted to the floors of the ship, with gusset plate extensions so as to form a transverse girder under the cylinders. Slide valves are fitted to each cylinder; the H.P. being an ordinary single ported, and the L.P. a "trick" valve giving a double opening to steam.

The pistons are hollow box castings fitted with two "Ramsbottom" rings each, the piston rods being of steel, secured to pistons by taper and nut, and keyed to the crossheads, which are steel castings. The cast-iron slippers work in guides in the main frames, and are fitted with large adjustable bronze plates.

The connecting rods, which are 10 feet, or two and one half times the stroke, between centres, are of malleable iron, parallel in diameter for one half their length, and tapering towards crosshead end, and are fitted at ends with brasses of large surface, which are easily adjustable.

The cranks are steel castings keyed to intermediate shaft, at right angles to each other, with H.P. leading, the crank-pins being secured to inner cranks by taper and nut, and free to some extent to move in outer cranks between steel plates. The shafting is of best hammered scrap, the main bearings being eight inches diameter by 10½ inches long, while the outboard bearings are nine inches diameter by 16 inches long. The main bearings, four in number, are formed with the main frame castings, and are supported on a shelf piece the width of the engine hatch athwart ship, which shelf is carried by a bulkhead extending across the ship almost directly under the centre line of shaft. The shelf is also supported, and the bulkhead stiffened, by fore and aft plates and gussets, under the centre of each bearing; this construction giving great transverse stiffness under the shaft, and ensuring the bearings being held in perfect alignment.



INCL COMP. ENG. 17 & 34 x 48. SCALE 1 INCH = 1 FOOT. GENERAL SIDE ELEVATION AND GENERAL DRAWING PLAN. BY A. P. RANKIN.

The main frames are of cast iron, of open girder section, suitable openings for the crosshead guides being formed in them, and the brackets for cross stays and reversing shaft bearings cast on. They are secured to cylinder ends by fitted bolts and studs, and each frame is supported at about the centre of its length by a diagonal stay, the bottom end of which rests on a steel I beam riveted to the floors of ship. The frames are connected together in pairs above and below the guides by stays

and distance pieces, and are tied by a continuous cross stay above the four main bearings.

The valve gear is of very substantial design of the double bar, link motion type, all wearing surfaces being large and adjustable. The eccentric rods are of wrought iron, with T end for attaching to straps, and fitted at link ends with cast steel forks and adjustable brasses. These rods are comparatively short, and the valve spindles are correspondingly long, thus making the parts to be moved by the reversing lever lighter, and facilitating the handling of the engine. The reversing lever is 7 feet long, stands 5 feet above the starting platform, and has a travel from "full ahead" to "full astern" of 4 feet 6 inches. The quadrant with the lever for operating the throttle and injection valves, is fastened to one of the main frames at a convenient distance from the reversing lever.

The condensing apparatus is placed below the L.P. engine, resting on the ship's floors. The air pump is vertical, single-acting, fitted with bucket and delivery valves, and connected to the jet condenser by a channel plate, in which is located the foot valve. From the ends of the air pump crosshead, the feed and bilge pumps are driven, the whole of the pumps being operated through wrought-iron levers and drag links from the crosshead end of L.P. connecting-rod. A bilge injection valve is fitted so that, when necessary, the bilges may be pumped out by the main engines through the air pump. The valves of all the pumps are arranged so as to be easily accessible.

The paddle-wheels are radial, 14 feet effective diameter, each wheel having 14 floats 4 feet 6 inches wide.

Steam is supplied by two steel boilers 54 inches diameter by 20 feet long, of the locomotive type, placed forward of the engines. They are built for a working pressure of 130 lbs. per sq. inch.

The estimated horse-power of the engines, at 40 revolutions per minute, is 300.

For THE CANADIAN ENGINEER.

SEWAGE DISPOSAL.

BY WILLIAM M. WATSON.

In previous articles on sewage disposal the writer described the International Purification System, which uses ferrozone for a precipitant and polarite for a filtrate. Compositions of the ferrozone and polarite used were also explained, and he commented on the cost and efficiency of the system. The Rivers Purification Company's system was taken up, which purifies sewage by carbonized refuse, such as vegetable garbage, excrements, etc., collected in towns, brought to a red heat in a muffled kiln and afterwards used to filter and purify the town's sewage. There was also a detailed description of the workings of the Bradford, Eng., sewage works, where a precipitant of milk of lime was used. The Amines system of using a mixture of herring brine and lime, the Conders process of using a solution of lime, and the native guano process were dealt with. All of these can be studied in the back numbers of THE CANADIAN ENGINEER.

I then stated that purification by land was impossible on account of the extreme climatic influences in this country, and even in a very mild climate such as New Zealand the land is often unsuitable Irrigation lands should be gritty and porous to a depth, at least, of four feet, and should be well and carefully under-drained. It was formerly supposed that vegetation was the principal factor in the cleaning and purifying process. In summer, vegetation will extract the manurial constituents, and powerfully assist in destroying the bacteria. But careful experiments prove that farm land is really a process of filtering, and that the purification is effected by oxidation. Therefore, irrigation lands must have periods of rest to allow time to secure aeration, and should never be drowned or water-logged; and to prevent it doing so, provision should be made to store the sewage during storms or severe frosts. By having separate drains for the carriage of sewage the flooding can be avoided, but I see little chance of providing for long periods of frost except by going to the unreasonable expense of covering the irrigation land in winter.

If the land is composed of adhesive loam, light loam, or light gravelly soil, the whole of the organic matter contained in the sewage can be removed. The underdrains should be in short lengths, close together, say every two feet, and the discharge end terminate in an open channel, so that air could freely pass through them to the land. Nearly all public authorities owning irrigation works consider that an untrained farm laborer is able to manage the works, the result being that, say, the $100,000 spent in shaking up the land and underdraining is lost, because the land gets fat and useless, the drains are choked, and the sewage passes through untreated.

Broad irrigation is effected by running the sewage direct on to farm lands, and on account of the tenacity of soil in holding in suspense moisture, sufficient land must be acquired to allow one square yard to each two gallons of sewage discharged per day in dry weather. The land would sometimes absorb a great deal more, but it requires to have periods of rest sometimes for as much as a month, and it is unsafe to allow an average of more than two gallons per yard per day. The amount could be increased by doing some draining to draw off the moisture. The land on the slope of a hill is the most suitable; low, flat land that is often waterlogged is useless. In most places it will necessitate pumping the sewage to the hill top. There is no fixed rule how to proceed in distributing the sewage on the land. Generally shallow channels are cut by a spade, and the sewage drawn from the nearest branch. Broad irrigation on farm lands is feasible where the city is built on a hill and there is plenty of arable land that is situated below the level of the main outlet of the sewer, and the land itself is high and dry above the storm water mark of the nearest water course. But except the town is fortunate enough to have these requirements, the system, if adopted, is expensive, and can only answer for a makeshift, useful in dry weather.

The Government in Great Britain for the past fifty years has demanded that all sewage shall pass through land during the final filtering stage. It happens that the majority of large towns are built in hollows and low lands bordering on the water courses, and on the banks of navigable rivers or seas, and only high enough to secure a good fall for the drains above the high water mark, and they cannot possibly introduce a simple inexpensive gravitation sewage works; but where six feet in depth can be secured it can be accomplished, by the screening bank and roughing filter being on the same level, then letting the clarified sewage come from the top of the roughing tank on to the land, thus doing without any machinery or sludge presses. Twenty feet is about the depth necessary to provide for the proper arrangement of a good self-acting works; it then gives space for mixing the precipitants by water power, and of shaking up the sewage water by water wheel or turbine, and the first or roughing filter can work downward, the clarified sewage passing out at the bottom of the tank and over a water wheel or rough stones to give it another shake up, and aerate it, then run along box-made channels on to the bacteria filter, composed of

fine charcoal, etc., made by the Jaggers' kilns from towns' refuse or other suitable material.

Where it is necessary for the roughing filter to work by an upward flow to save pumping, and where there is under 10 feet of depth to work on, it will require an apparatus to clear the sludge settling at the bottom of the tank. Candy invented a revolving pipe to suck it out, which is clumsy, and expensive, and soon disarranged. There is another method simpler, cheaper and more efficient.

Every system of purifying sewage depends largely on the qualification of the manager and attendant for its efficiency. To properly manage a sewage disposal works requires a man with a thoughtful and creative mind, well-informed on most technical subjects, one who will sift things to the bottom, and who will take a lively interest in his work.

The judgment used in selecting employees for such important and responsible positions, means the saving or the wasting of a large amount of money, and the improvement or decline of the general public's health. In fact, the success or failure of many costly sewage works is due to the personal qualities of the manager.

We now come to the precipitants, and my experience with regard to them is that there is considerable humbug in connection with them. There is a great variety of sewage; one is dye-polluted water, that is permeated by strong chemicals. The chemicals and colors having got a good grip on the dye water, then a chemical or other substance must be employed to compel them to let go their hold, and allow the water to return to its pure state. There are at least one hundred different kinds of precipitants used in Great Britain, and I believe that in half the cases powdered clay would answer for the purpose of dividing the solids from the water better than the more expensive precipitants. Clay has been successful when the chemicals would not make any impression. If many of the marketed precipitants that have high-sounding names are examined, powdered clay, and sometimes charcoal, will be found to form a part of the mixture.

The art of purifying sewage is now being revolutionized, and if it were not that the British people are very slow to take up a new idea, the general use of precipitants in England would have been a thing of the past some time ago.

The Messrs. Jaggers showed the officials their invention of carbonizing town refuse and afterwards using the product for purifying sewage, and proved that they could secure the best effluent, but the Local Government Board refused to permit works to be constructed without using irrigation land for the final process of filtration. And as the towns did not wish having two methods, they were compelled to obey orders (except a few like Baildon, which risked having their own way), and take the method of land irrigation, and to prevent the land from getting too fat or dirty, they are compelled to clarify the sewage in settling tanks, using precipitants to be able to handle it quickly—which, when the cost is placed alongside the cost of the new idea, is often about 75 per cent. more. Strange to say, we find that those towns which have lately got sewage works in Canada have selected a system or a mix up of the parts of several systems that can hardly do good work. The effluent discharged from them is probably dangerous.

An effluent may appear clean after clarification and the solids have been extracted by settling tanks and precipitants, but they have only taken out what is chiefly offensive to the eye, viz.: manurial, fœcal, and heavy substances that do little harm until allowed to putrefy, but the chief reason for needing purification is still in the sewage water, held in suspension, viz.: albuminoids, ammonia, free ammonia, chlorine, alkalies, etc, which are all good in their proper place, but are decidedly in the wrong place when they are in water that may be used to water cattle and promote fish life.

There is a kind of sewage discharged by slaughter houses, wool and skin washers, and by large hotels or restaurants, that is heavily charged with blood, grease and fat. By using a precipitant of bisulphide of carbon it may be made to settle down; but when the sludge is put into a press only 23 per cent. of the moisture can be extracted and the sludge still remains a liquid. If it could be pressed clear of the moisture and made into a cake, it would be valuable for fuel and gas making. Even after clarification the whole of the fat is not removed, and when it passes to the filters, stops up the air cells of the filtrate, of course partly destroying the filter's purifying power. Slaughter houses and wool and skin washers should always be compelled to clarify their sewage before discharging it into the public sewers. In England there is a firm contracts to extract the fat for the right of taking it away for sale. Hotels and restaurants should have a grease trap connected with kitchen and pantry sinks, for grease is the worst enemy to sewage works and drain.

Those towns which have adopted the Jaggers carbonized refuse filters can dispose of greasy sewage without the use of precipitants, because coming on to the filters in a raw state, and having to pass down through a fine powdered charcoal, it leaves the grease on the surface, which in a short time covers the filter and stops the flow, when it can be scraped off, along with about two inches of the charcoal which has become contaminated.

Mr. Pasteur and Mr. Warrington both declared years ago that sewage contained the organisms necessary for its own destruction, and with the combined efforts of engineers, chemists and biologists it will soon be accomplished. They have proved that there is a great variety of minute organisms in sewage and land, and that in the colonies of bacteria there is a marked difference in their tastes and habits. Some are very dangerous to the public health, and must be destroyed or they will destroy us. On the other hand, there are other colonies that, so far as the public health is concerned, are harmless, but they kill and destroy the dangerous ones. On this account we are now making the friendly ones useful by setting them to destroy the dangerous ones. And it is now believed that ever since 1762, when filtering sewage was begun to be cleaned by passing it through land, that it has always been partly done by our allies the bacteria, and only very slightly by growing vegetation. We now are certain that the filtrate, whether composed of sand, rubble, spar, coke, coke breeze, carbon and iron-coal, charcoal, or charcoal made from refuse, that its value consisted only in its qualifications for becoming a comfortable lodging house to the bacteria.

Now the latest improvement is purification by bacteria filters, sometimes called purifying by microbes. In England there are about five small towns working on this principle of allowing the sewage to purify itself by natural processes. Each of the places do it by different ways, and patents are, I believe, placed on each method. Some use the settling tanks and precipitants; others make a darkened tank answer in place of a precipitant and settling tank, and another by passing the raw sewage through a roughing filter to clarify, then through the bacteria filter to purify. The advantages of the bacteria filter are that it eats up all the injurious matter and dirt except grit,

sand, etc., and by so doing does away with sludge and expensive machinery used for mixing precipitants, pressing, pumping, etc., and perhaps the greatest advantage is that the works do not require so much depth as the old complicated system.

So it seems probable that the sewage works of the future will have a roughing filter, and if sufficient depth of land can be secured the sewage will be run on raw from the sewer. Then it will pass through carbon of some kind or a substance of a similar nature; then out at the bottom and through troughs to the filter, where it will be split up and rained on to the filter in small streams. Each filter will contain over three feet in thickness of filtrate properly packed together, but in such a manner that the air can get through and supply the bacteria with the oxygen they always need to assist them to carry on the work of nitrification, and enable them to discharge the hydrogen that they manufacture.

If there is not sufficient depth to allow both filters to have a downward flow, the roughing filter must work with an upward flow, which will save four feet, and it may have a very simple contrivance attached to clear the bottom of sludge and bring it to the surface of the ground. To work a sewage business of this kind will cost very little, and the cost of land and construction will be small in comparison to that, for instance, of the Hamilton, Ont., stamp. The filters can be constructed so that they will filter 200 gallons of sewage per square yard per day, or if you choose to say cubic yard per day, for we should make the filtrate at least a yard deep.

The next point is what is the best material for use as a filtrate. The State Sanitary Board of Massachusetts at Boston has conferred a great benefit on the world by making exhaustive experiments into the sewage purification business, also into the habits of bacteria life and their use for filtering purposes. They used sand of various kinds, pebbles, broken stone, gravel and similar materials, but no carbon of any kind or charcoal. They showed us how the climate acted on the filtering material and what season of the year the bacteria works the best. The stony kind of material is, in my opinion, too cold. In England, coke or coke breeze has been the favorite filtrate for a long time. I used this material and it gave fairly good results, but we knew of nothing better then. Mr. Garfield, the manager for Wolverhampton, Staffordshire, England, happened to observe a very filthy stream run on to a heap of soft coal screenings, and he also observed that when it run out at the bottom of the pile it was equal to spring water. Being an intelligent man, he lost nothing by his observation, but quickly tested its purifying power in his sewage works, which went all right; so they use small coal for filtering at Wolverhampton. This find is almost as good as a Klondike to England, because they have hundreds of large pit hills composed of screenings, shale, etc., that they formerly could not sell.

Having no coal to spare in this country, and seeing that we burn the very dust, the find will be of no value, only in places where a coal mine is located. Professor Peat for a short time purified sewage with wood charcoal and secured a pure effluent, but the cost could not be tolerated. Benj. and H. B. Jagger, of the Rivers Purification Company, Limited, of Southport, Eng., have found a method of making a powdered charcoal from towns' refuse and garbage, which answered even better than wood charcoal, and supplies a material that suits better than anything else for the bacteria filter.

The idea that charcoal was the best filtrate is very ancient. Where the Jaggers system is used, as at Baildon, Yorkshire, Eng., and other places, a muffled kiln is built near the filters, and the excrements from privies, ashes, vegetable refuse, street sweepings, bad meat, or any offensive material is taken and tipped into the destructor or kiln, brought to a red heat, then withdrawn, cooled and riddled, and then used to filter the sewage. It has been shown that it is necessary when constructing any kind of a sewage or water filter to make a proper provision for the passing of air through the filtrate. If they succeed in being able to aerate a filter, and at the same time be passing sewage through it, then the sewage works will need very little attention after having been once started, and the cost of management will be reduced to a fraction, because the sewage will be continually running through and there will be no machinery or sludge to care for. There are two patents already out which profess to be able to meet this requirement. Mr. Lowcock has got a method of putting perforated pipes in the centre of the filtrate, connected with a fan blower that is driven by power got from the stream of sewage coming down the sewer to the works. The fan forces the air into the filters at a pressure of five inches of water. He proves that this supplies all the needed oxygen, and there is no need to stop the filter to aerate. In my opinion the method will stand improving, for if the filtrate is water-logged or immersed in water I cannot see how five inches of pressure is going to travel 18 inches, and should it travel upward it will never travel downward and aerate the lower half. I am quite aware that the most work is done in the first 12 inches of filtrate at the top, and on this ground it may answer.

There is another inventor who builds the filtrate on a grating, leaving an air space of about a foot between the concrete bottom and the bearing grate. In the walls of the filter tank he builds a quantity of air shafts and raises them to several feet above the filter level, then fixes Howarth screw ventilators. These being driven by the wind of course create a vacuum in the air space under the bottom of the filtrate, which causes a quantity of air to come down with the water, for in this case the filter cannot be water-logged or the air space at bottom would be choked. Of course the water or effluent, when passing out of the filter, is trapped to prevent air coming in that way. I believe this system will be improved on, especially when the Jaggers system is the filtrate, because having considerable heat at the kiln it could be utilized to increase the draughts without using ventilators.

There is another way to aerate which certainly gives plenty of air to the filter, but requires a great deal of machinery and attention and makes it costly. It is used by the International Sewage Purification Company, in England, but, I believe, not by their agent out here. They found that passing water through even polarite (which is composed of sesquioxide of iron, 53.98; silica, 15.10; magnetic oxide of iron, 19.19; protoxide of iron, 7.25; calcium oxide, 1.42; carbon, 1.80) did not purify the water when kept running, and the Government inspectors would not permit the effluent to be discharged. They have now altered their system, and the sewage is discharged suddenly on to the filters by self-acting valves and troughs which are constructed to hold the quantity necessary for one charge. It is thrown on quickly, so that the air contained in the filtrate cannot escape. The sewage settles down, forcing the air before it, and as it lowers below the surface, of course draws a fresh supply of air into the polarite. It takes under two minutes to spread the water on, and they allow eighteen minutes to pass out, and the polarite to get re-aerated, so the cycle takes twenty minutes.

It is estimated that one thousand population discharges 156 pounds of solids and 260 gallons of urine each day. It appears to me to be a wilful waste to have all that valuable manure converted into hydrogen, and blown away for every plant to share in it, when by spreading it on our land it would enrich the land and increase the crops.

Sewage that is allowed to stand and ferment as it is in the sewage irrigation works at Berlin, Ont., and which contains about the usual amount of organic matter per gallon, will give out 1½ cubic inches foul gas per hour per gallon. This shows that irrigation works where the land is allowed to get waterlogged, as the land does in Berlin, is a menace to the health of the country.

The average composition of the sewage in the small towns of Ontario is about as follows, viz. :

Organic matter.....	.....27.72	grains to	each gallon.
Nitrogen	6.21	"	"
Phosphoric acid	1.57	"	"
Potash, about	2.03	"	"

When some of this weak sewage is placed under a powerful microscope it is shown to contain various dead and decaying matters, also multitudes of bacteria, but few of the higher class of microbes ; neither does the heavier sewage, and when a new bacteria filter is started it must be supplied with a sufficient number of colonies of the sewage destroying kinds. So in the first place it must be filled by an effluent running from another filter and allowed to stand for a time until the bacteria can sufficiently increase.

ROLLER BEARINGS.*

BY W. BAYLEY MARSHALL, M. INST. C.E.

The application of rolling motion to bearings has been rendered practical within the last year or two. The author referred to (*a*) the advantages which might reasonably be expected to accrue from the use of roller bearings, (*b*) the requirements of satisfactory bearings constructed on this principle, and (*c*) some of the results which have lately been obtained from the adaptation of such bearings to rolling stock and other purposes.

(*a*) *As to the advantages arising from the use of roller bearings.*—It is an interesting fact that although full knowledge has existed from the earliest days of the advantages of rolling motion when applied to tractive purposes, as shown by the use of wheels or rollers, for reducing the effort required to transport heavy loads, it is only within comparatively recent times that serious attempts have been made to substitute such motion for the ordinary rubbing or scrubbing friction between the axles or journals of such wheels or rollers and their bearings. If by the introduction of rolling motion between the journals and bearings of the rolling stock or between the wheels and axles of the road vehicles, as the case may be, a further and very considerable reduction in the effort required to move any given load can be obtained, and this at a comparatively small additional monetary expenditure, far outbalanced by the consequent economy, it would seem that such application must become general. The following are, amongst others, the principal advantages claimed for roller bearings: Great reduction in starting effort; decreased tractive effort; decreased revolving effort; economy in lubrication.

The reduction in the effort required to start vehicles or shafts fitted with roller bearings, as compared with those fitted with ordinary bearings, is of such importance that if it were the only advantage it would warrant the necessary additional monetary expenditure. Although it is not claimed that the reduction in tractive force will be so large in proportion to that in starting effort, it must be remembered that this force is in application during the whole of the time a vehicle is running on level ground or ascending gradients; this point, therefore, becomes of great importance when the total amount of work done is calculated.

The decreased revolving effort is of great economical value in all cases of heavily loaded shafting, as careful experiments have shown that the amount of power required to drive the main and counter shafts in workshops, all the tools being idle, amounts to as much as from 50 to 80 per cent. of the power required when all the tools are in full work; these figures show that there is ample room for improvement in shafting bearings. The economy in lubrication is a considerable item, seeing that a perfectly constructed roller bearing does not require any lubrication but only sufficient oil need be applied to prevent the rusting of the various parts.

The various parts must be proportioned with reference to their relative movements, so that nothing but rolling motion takes place between the surfaces engaged. The bearing rollers must be kept parallel with the axis of the axle or journal upon which they run, that they must not be allowed to touch each other, and that they must be of sufficient diameter and length to bear the fatigue of the duty they have to perform. Adequate provision must be made to meet the end thrust, not only of the rollers, but also of the axle or shaft when revolving within a fixed bearing, or of the bearing itself, when revolving upon a fixed axle. The bearing must contain as few working parts, and these as simple as possible. The most important from a commercial point of view is that the bearings shall be produced at reasonable cost.

For many years the only successful application of rolling motion to bearings was the well-known "ball-bearing" so universally adopted for cycles, and although these bearings have been found most satisfactory when subjected to light loads, all attempts to apply them to heavy ones have, so far as the author knows, resulted in failure, these failures arising chiefly from the balls indenting the paths or races upon which they run. Directly this takes place the balls begin to lose their friction-reducing properties. If a semi-circular trough be constructed which accurately fits a ball, and after the ball is placed therein, one end of the trough is lifted until movement of ball takes plaee, it will be found that the ball moves by sliding and not by rolling; this is indentation carried to its extreme limit. Another defect in the ball bearing is that the balls are allowed to touch each other, and as the touching points of any two balls are revolving in opposite directions, there must be a certain amount of scrubbing friction.

Improvements which have been made recently in the use of roller bearings are making their employment in general traction more common, and are seen on a number of English railways, on some of which the tests were made, from which the following data were compiled :

A passenger train of six carriages, fitted with roller bearings throughout, has been running for two years between Brighton and Kemp Town, with a total mileage of over 70,000, and has shown a saving of from 12½ to 15 per cent. in the consumption of fuel, which saving has been obtained under most disadvantageous circumstances, inasmuch as the engine has to be kept in steam for about 16 hours per diem, whilst its actual running time is under seven hours.

A tramway car fitted with ordinary bearings and

* Abstract of a paper read before the Toronto meeting of the British Association for the Advancement of Science.

weighing 2 tons 15 cwt. was let loose from a point 56 feet up an incline with 1 foot 6¼ inches rise. It ran down this incline and 57 feet along the level line at foot of same, or a total distance of 113 feet. The force expended was therefore 6,160 lbs. falling through 1.521 etc., feet, or 9,364 foot-lbs. The average frictional resistance was 9,364 ÷ 113, or nearly 83 lbs., equal to 30.5 lbs. per ton. A similar car fitted with roller bearings being let loose from the same point, ran the full length of the level line available, namely, 320 feet, and had not then quite come to rest, the total distance traversed being 376 feet. The force expended was as above, 9,364 foot-lbs. The average frictional resistance was 9,364 ÷ 376 = 24.9 lbs., or about 9 lbs. per ton of load. A saving of 70 per cent. Relative starting effort of a tramcar on a gradient of 1 in 20, ordinary bearings 100, roller bearings 77, saving 23 per cent., ditto, ditto, on a gradient of 1 in 80, ordinary bearings 100, roller bearings 50, saving 50 per cent., ditto, ditto, on a gradient of 1 in 140, ordinary bearings 100, roller bearings 39.6, saving 60.4 per cent.—results which require no comment. Perhaps one of the most interesting amongst the general applications of these bearings is that of the big bell at St. Paul's Cathedral, "Great Paul," which with its headstock and other moving parts weighs nearly 25 tons, and which gave considerable trouble when mounted on ordinary bearings. The following results are instructive: When mounted on the ordinary bearings the bell came to rest—after the swinging effort had been discontinued—within one minute, when on roller bearings in 6 minutes 55 seconds, showing that the frictional resistance of the latter was only about one-seventh of the former, a result remarkably in accordance with the starting effort tests given under the head of "Tramways." With reference to the question of heating it is an interesting fact that there has not been a single case of a hot bearing in all the experience so far gained with roller bearings.

Although it is somewhat early to predict what the cost of maintaining these bearings will be, the results so far show that if they are constructed of suitable materials, it will be extremely low; 60,000 miles in railway work and over three years in tramway work, with but very slight wear are most encouraging. It has been found that polished compressed steel is the best material for the rollers, cast steel for the cases in railway and heavy shafting bearings, and hard cast iron for tramcar and other lightly loaded and slow-running bearings.

We have been compelled to hold over a quantity of interesting matter, including a report of the meeting of the British Association for the Advancement of Science, held in Toronto last month.

UNUSUAL MINING.*

BY J. T. DONALD.

Lac a la Tortue (Turtle Lake), 21 miles from the city of Three Rivers, on the Piles branch of the Canadian Pacific Railway, is a very curious iron mine, worked by the Canadian Iron Furnace Company, which operates a modern water-jacket furnace at Radnor, 10 miles distant. This lake is a body of water about four miles long by one and one-quarter miles in average width, occupying the centre of a large area of swampy land. The surrounding land is largely composed of sand formed by the wearing down of the Archaean rocks by glacial action. It is well known that decaying vegetable matter yields acids that dissolve the oxide of iron. Evidence of this solvent action of vegetable acids on iron are frequently seen in pieces of slate. The slate is colored by iron, but frequently white or light-colored spots occur. These are points where a leaf or a fragment of bark has been deposited with the fine mud, in which form the slate was deposited. The leaf or bark has decayed; the vegetable acids thus formed have dissolved the iron oxide to which the color of the slate was due, and of course a white or colorless patch is formed.

In the sandy area around Lac a la Tortue we find the most favorable conditions for the action of vegetable acids on iron oxide. The sandy land produces a rank vegetation, and its decay furnishes abundance of organic acids. These acids are in solution in the drainage waters, which on their way to the lake percolate through the sand. They thus come into contact with the iron oxide in the finely divided materials, dissolve it, and carry it along to the lake. Here a new chemical action comes into play. The solution of iron in vegetable acid (in which the iron is in what the chemist calls the form of a protosalt) is oxidized by the action of the air on the surface of the lake into a persalt, which is insoluble, and appears on the surface in patches that display the peculiar iridescence characteristic of petroleum floating on water. Indeed, not infrequently these films of peroxide of iron are incorrectly attributed to petroleum. These films become heavy by addition of new particles, they sink through the water, and in this manner, in time, a large amount of the iron ore is deposited on the lake bottom. It must not be supposed that the ore is deposited as a fine mud or sediment. On the contrary, in this lake ore, as it is called, we have an excellent illustration of what is known as concretionary action—that is, the tendency of matter when in a fine state of division to aggregate its particles into masses about some central nucleus which may be a fragment of the sunken wood, a grain of sand, or indeed a preformed small mass of itself. Precipitated in water, as our lake ore is, it of course has great freedom of movement, and we, therefore, find it in flat concretions, more or less porous and circular in outline; the general appearance amply justifying the term "cake ore," which is locally applied. These concretions vary much in size, some of them being no longer than mustard seeds, others 8 or 10 or more inches in diameter. Frequently the larger cakes are joined together and form masses looking not unlike batches of a certain kind of bun commonly exposed in the shop window of every confectioner, and made by coiling a strip of dough round and round a piece of itself.

The ore is not found over the whole lake bottom; it occurs along the whole margin, and also well out from shore where streams enter the lake, the distance of the ore deposit from shore depending, of course, upon the volume of water carried by the streams and the velocity with which it enters the lake. Certain strips of ore occur at a considerable distance from the shore, and in as much as 16 ft. of water. These deep-water, mid-lake deposits denote probably the courses of former streams which are now non-existent, owing to some change of level. The ore is extracted from this lake-mine by hand and by power; the shallow margins are worked by hand, while from the deeper parts of the lake the ore is raised by means of a steam dredge.

A short time ago the writer was instructed by the proprietors to make an examination of the lake-mine and report the quantity of ore in sight. From the description of the mine already given, it will be seen that the task allotted was a somewhat unusual one. A certain amount of planning and experimenting was necessary before any satisfactory method of getting at the quantity could be determined upon, but finally the following method was adopted, and found to work admirably:

A number of lengths of 1-in. gas pipe were coupled into one length of about 30 ft., and this, resting on the stern of a scow, was pushed down into the water until the end rested on the bottom of the lake. The scow was towed by a tug backward and forward over the whole lake. When an ore deposit was reached, its presence was indicated by the vibratory motion of the long pipe, caused by the end slipping from cake to cake of the ore. When no ore was at hand the end of the pipe slid smoothly along the firm sand, for fortunately nothing coarser than sand is found in the lake except ore cakes. When a deposit of ore had been located and its superficial extent determined as above indicated, the quantity of ore per square foot of each deposit was determined as follows: An iron tube about 2 1-2 feet in diameter was lowered from the side of the scow into the deposit and worked down until it passed through the ore layer into the sand beneath; then, by means of an implement like a telegraph spoon and by long-handled tongs and grappling irons, all the ore within the area of the tube was brought up to the deck of the scow, where it was examined and

*From *The Engineering and Mining Journal.*

weighed. This was done at several points in each deposit, and having already determined the extent of the deposit it was an easy matter to estimate the ore in sight in each.

By this method it is believed that a very reliable estimate of the quantity of ore in the lake was obtained; certain it is that the estimate made by the writer differs materially from those that had been made by other means. It must be added in conclusion, that this lake-mine is something like the widow's cruse of oil of which we read in Holy Writ—the supply is being constantly renewed. Vast amounts of iron still exist in the surrounding sands. Vegetable acids are formed from the decay of each year's vegetation, and each year the drainage carries into the lake and deposits there a large amount of iron. This is no mere theory; one can actually see the deposition of the ore along the margin, and, moreover, it is found in actual working; if a certain spot be worked out it will in a few years again yield ore in paying quantity.

HOW TO MAKE A SIMPLE STEAM CALORIMETER.*

BY M. THOMAS FULLAN.

In these latter days of keen competition, it is desirable to take every advantage, and to correct all sources of loss from whatever cause. The fact that many boilers, particularly when forced or overworked, produce wet steam, is well known, but the amount of this moisture, or even the fact of its existence, is not always easily determined.

Many engineers have not access to the expensive instruments for determining the same, and in view of this last fact, I herewith submit a short description, with sketches, of a very simple "throttling" calorimeter, which any engineer may construct for himself, at the nominal expense of a few pipe fittings and a steam thermometer, which may be purchased for a couple of dollars.

Fig. 1 shows the calorimeter assembled in position for use, connected to a steam pipe; when possible, it should be connected to a vertical pipe, as shown. The body of the instrument may be made of a 1-inch T fitting, into the top of which is screwed the bushing, *B* (Fig. 2); into the bushing, *B*, is fitted the thermometer tube, *T*, which is made of brass, turned down, as shown, sufficiently thin to readily

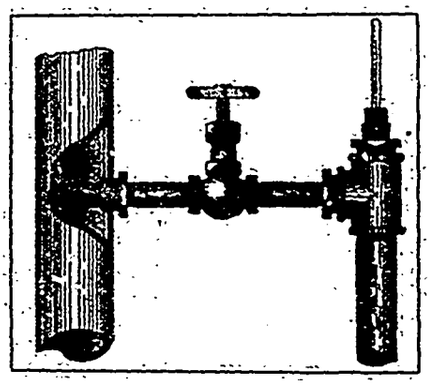


FIG. 1.

transmit heat, and the mouth of the tube is somewhat cupped. The steam pipe *S*, made of ½-inch pipe, is threaded sufficiently long, so that after having been screwed into the bushing, *D*, it will accommodate a ½-inch cap, *C*, which is screwed on the end, making a steam-tight joint with the bushing, *D*. Into the centre of the cap is drilled a small hole, about ⅛ inch in diameter, countersunk on both sides, the function of which is to "throttle" the steam.

Care should be taken in obtaining, as near as possible, the best specimen of steam in the supply pipe, so it is advisable to connect up, as shown in Fig. 1, by inserting the feed pipe, *S*, the end of which is perforated, into the centre of the supply pipe. If it is simply screwed in, as is ordinarily done, some of the condensed steam, which invariably exists, would, in trickling down the side, enter the calorimeter and cause an error. The exhaust pipe, which leads from the bottom of the instrument, may be of any convenient length. Fig. 2 shows other views of the thermometer tube and throttling nozzle.

This type of calorimeter, termed "throttling," was developed by Prof. R. C. Carpenter, of Cornell University, and the principle upon which it operates is as follows:

Some of the heat contained in high pressure steam is liberated when the pressure is lowered, and that heat is utilized in evaporating any water the steam may contain, and in raising the temperature of the steam above that due to its pressure. Thus, for example, the total heat in 1 lb. of steam at 80 lbs. absolute pressure is 1,177 B. T. U. (British Thermal Units), and that in 1 lb. at 20 lbs. absolute pressure

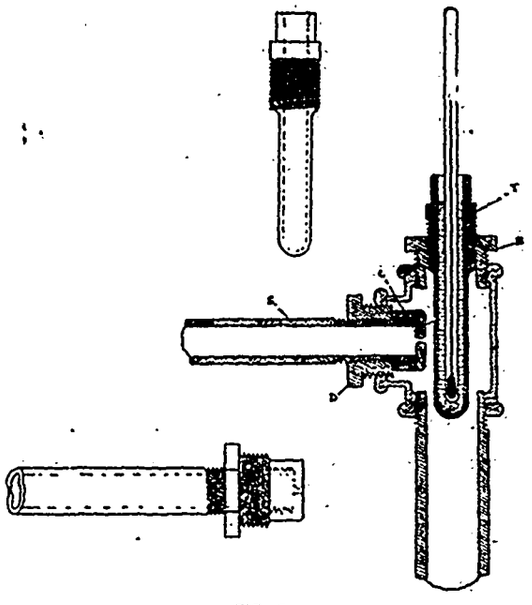


FIG 2

is 1,151 B. T. U. If, now, steam were allowed to expand without doing work on any body except itself, from 80 lbs. to 20 lbs. pressure, 26 B. T. U. would be liberated for each pound of steam. Since, at 20 lbs. pressure 954 B. T. U. are required to evaporate 1 lb. of water, we should have additional heat sufficient to evaporate 26÷954, or .027 lbs.

Now, if the original steam contained less than 2.7 per cent. of moisture, a thermometer placed in the steam would show a temperature higher than that due to a pressure of 20 lbs., which is 228° F. In such a case it would be possible to compute the percentage of moisture in the steam; but if the steam contained more than the above percentage of moisture, the heat would not be sufficient to evaporate it, and the reading of the thermometer would be equal to that of the boiling point of the given temperature; thus no computation of the moisture contained in the steam could be possible. That is, a throttling calorimeter cannot be used if the steam contains much over 2.5 per cent. of moisture, but it is very convenient and accurate within its limits of operation.

To operate the instrument, connect up as shown and fill the thermometer tube with some heavy oil, cylinder oil probably being the best. Now, having inserted the thermometer, open the valve and allow steam to flow until the temperature has become constant, which will be but a short while; when the conditions are such, read the thermometer, the operation then being complete.

The quality of the steam may be then readily found by substituting in the following formula:

$Q = [H - S + .48\ (T - 212)] \div L$, where Q = quality of steam; H = total heat at atmospheric pressure; S = temperature of steam in boiler at absolute pressure (gauge pressure + 14.7 lbs.); T = temperature observed in calorimeter, that is, reading on thermometer; L = latent heat of steam in boiler at absolute pressure.

Values of H, S and L, may be found by consulting steam tables found in all mechanical handbooks, and are also furnished gratis by some builders of boilers. The percentage of moisture is, of course, $100 - Q$.

SAFETY VALVE PROBLEM.

In our July issue we printed a solution of a safety valve problem in which the weight required on the lever was incorrectly stated. The conditions were: lever, 36 inches; diameter of valve, 3 inches; fulcrum, 3 inches; pressure 125 lbs. The required weight on the lever is 73.625 lbs. The formula for solving such problems is:—

Area of valve = A. = 7.068.
Length from fulcrum to weight = L. = 36".
Length from fulcrum to valve = l. = 3".
Weight of ball = W.
Load on safety valve = area × pressure.
Steam pressure = 125 lbs. = p.
Weight of valve and lever not taken into account.

$$W = \frac{A \times p \times l}{L.}$$

$$W = \frac{7.068 \times 125 \times 3}{36}$$

$$W = 73.625 \text{ lbs.}$$

* From the *American Electrician*.

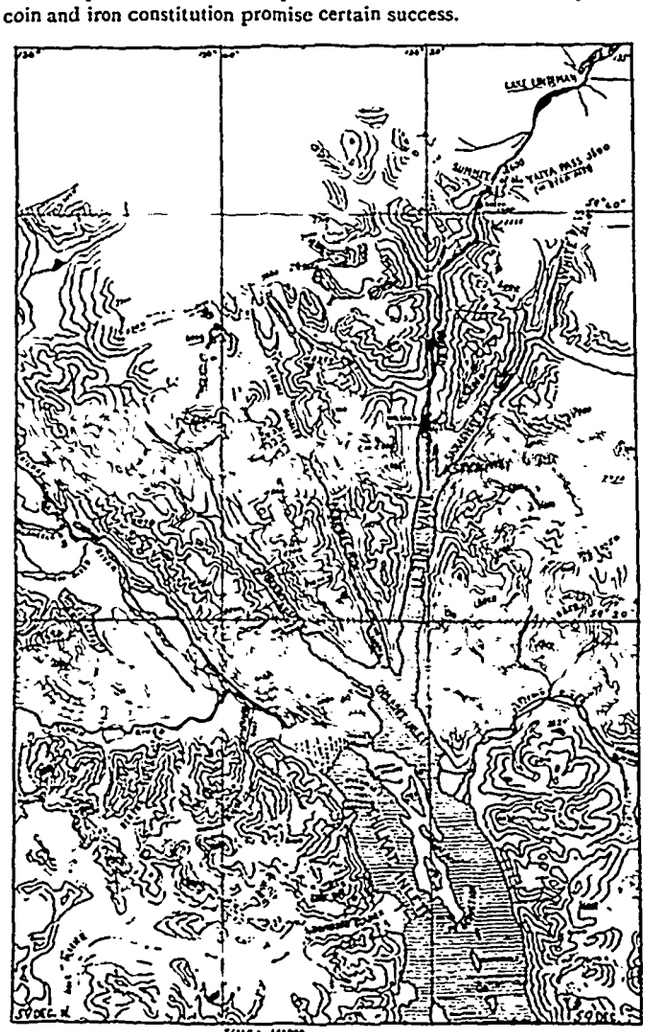
From a mountain 6,250 feet high between Davidson and Rainbow Glaciers, looking northerly.

From a mountain 6,250 feet high near Davidson Glacier, looking N. E. towards the mouth of the Katzchin River.

A PANORAMA OF THE INLET LEA

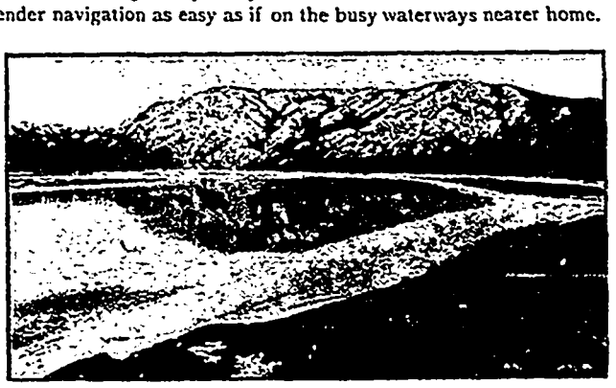
THE CANADIAN YUKON GOLD FIELDS.

The London *Punch* published the other day a cartoon on the Klondike which will not be very comforting to those whose friends have already started for this world-famous region. It depicts a mountain with a shining golden summit. Death, accompanied by ravenous wolves and a polar bear, sardonically watches the struggling climbers. The one nearest the bear is already exhausted, and those behind him are appealing, without hope, to the gold which has become to them a god Such a picture will serve a useful purpose in making the grapes seem sour to those whose poverty or delicacy prevents their attempting the enterprise, and also as a powerful hint to those whose capital of coin and iron constitution promise certain success.



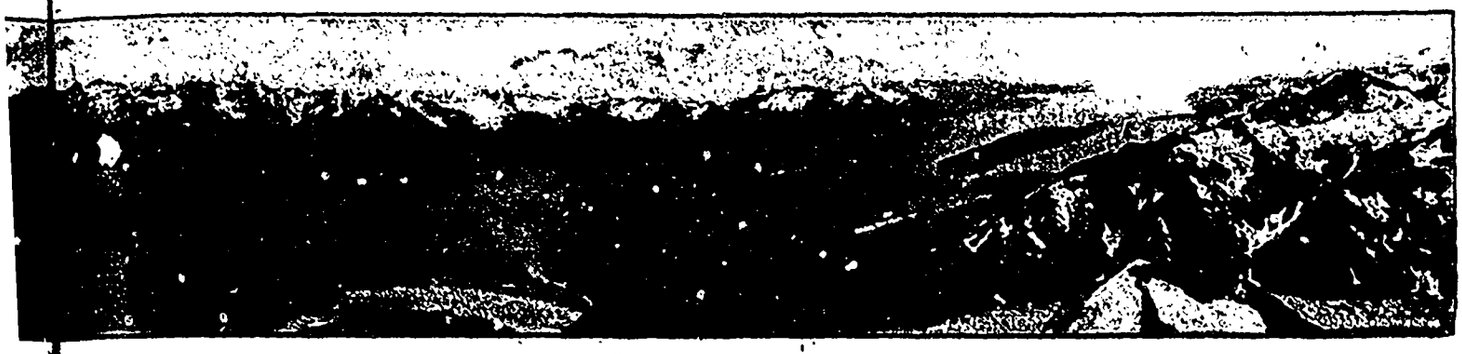
The Dominion Government has energetically taken up the task of regulating the mining operations of the Klondike and the improvement of the means of transport, etc., is engaging its earnest attention. One of the most important operations is the survey of the White Pass—the easiest route from Dyea or Shkagway. This is being done by C. E. Carthside, a civil engineer of Juneau, and six assistants, at the instance of an English syndicate which intends to run a railway from Shkagway, a few miles from Dyea, to the Hootalinqua River, a distance of 110 miles. The highest altitude to be reached is the summit of the Pass, 2,600 feet, about 20 miles from Shkagway, where wharves and warehouses are to be built. This surveying party has been at work since the 28th July, and is already twelve miles up the river. The work is to be pushed on so that the line will be completed as far as Taku Arm next year. At present this pass, though the easiest, presents terrible obstacles, and it is so difficult to get horses over it that the track is dotted with baggage abandoned until a more favorable opportunity arrives for its carriage. But a line even to Taku Arm will considerably lessen the difficulty and land the miner near a waterway which is navigable for miles at a stretch through the Teslin and Lewes Rivers into the Klondike itself at Fort Selkirk.

Many other schemes are being talked over, such as transport cables, etc., and meanwhile a force of about 1,000 miners who are obliged to wait for a favorable opportunity to transport their baggage, are at work on the trails with pick and dynamite preparatory to the work of the shack builders and trail makers sent out by the Government. In addition to this, new steamship companies are incorporated almost daily. The North-West Trading and Transportation Co. has just let a contract for three more steamers which are to ply the Yukon between St. Michaels and Dawson City. That means that this company alone will have eight steamers on the Yukon. Up to the present, navigation has been very difficult, but a company of New York capitalists is building a gigantic dredge capable of removing about 900 tons of sand or gravel per day. And this is to traverse the Yukon and render navigation as easy as if on the busy waterways nearer home.



LOOKING DOWN THE YUKON FROM OGILVIE'S OBSERVATORY.
From a Photo by Capt. Deville, Surveyor-General.

In the holding of a claim, might is still right, but the might of the individual is now substituted for that of wise government regulations and protection. Inspector Constantine has been for some time acting as commissioner in the Klondike, empowered to fix the limits of all claims and report them officially. Until the arrival of the new administration he is acting in a semi-judicial capacity and settles all disputes under the direction of the Government at Ottawa. This primitive arrangement was not, however, intended as permanent, and Major Walsh, of Brockville, has been appointed as administrator of the district and commander of the Mounted Police. The major's qualifications and the popularity of his appointment have received so much attention from the daily press that it is unnecessary for us to add anything on that head. The new administrator does not at present intend to hold his office for a long period, but he will see the territory in thoroughly good working order before he returns to his home in Brockville. Lieut.-Col. Henry Aylmer, of Winnipeg, was appointed as clerk of the court and registrar. He has since resigned that post, but there is no lack of applicants, and the office will be filled by some other qualified person. The Minister of the Interior has decided



From a mountain 6,350 feet high between Davidson and Rainbow Glaciers, looking east towards Point Seduction.

From a mountain 6,250 feet high between Davidson and Rainbow Glaciers, looking S. S.-E. down Lynn Canal.

From Photos by W. F. King, Chief Astronomer to the Dominion Government.

.EA[illegible]NG TO THE KLONDIKE PASSES.

to accompany the major and his party as far as Tagish, so as to inspect for himself the facilities for landing passengers and traffic, and conveying them over the summits of the passes. In order to keep the balance of justice in case of differences or crime, Judge McGuire, of Prince Albert, has been transferred to Dawson City, where his court will be held. A gold commissioner has been appointed to take over some of the duties hitherto performed by Inspector Constantine, and has power to make such regulations as his experience proves necessary for enforcing the law on placer mining, and a force of eighty Mounted Police, with a Maxim gun, are already on the way. This force is likely to be increased to 125.

The arrangements for the carrying of mails are nearly complete. This has been done by the friendly co-operation of the Canadian and American Governments. The latter Government will carry the mails free from Victoria to Dyea, when they will be handed over to the Mounted Police, and the Canadian Government undertakes that the mail shall be carried once a month between Dawson City and Dyea, Both these cities will be declared International Postage Exchange offices. There are already post offices at Dawson City, Fort Cudahy, and Forty Mile, and others will necessarily follow. This arrangement is to be supplemented by the work of a Government commission consisting of an astronomer, surveyors, geologists, and telegraph experts, part of whose business will be the establishment of telegraph communication between the various important points and telephone lines between the principal mining camps. That so much has already been done for a hitherto almost inaccessible district in the interest of human life and comfort, affords a strong presumption that ere long the only deterrent will be that of the climate, and even that is in some measure subservient to the advances of industry and civilization.

Both Dawson City and Shkagway are assuming the appearance of municipalities. Late last year the inhabitants of Dawson City numbered 4,000, and Mr. Ladue, who owns the site, estimates that next June it will have run up to 25,000. It may not, of course, remain at that figure; but a residue of the miners, and the certain increase of stores of various kinds, will make Dawson a very considerable town. Already it has a saw mill and Presbyterian, Baptist, Methodist and Roman Catholic churches. It is the headquarters of the Mounted Police, and the Government intends to establish a bank there, where the gold of the miners can be deposited and exchanged for drafts. This will, of course, necessitate the establishment of an assay office. Shkagway has already a Broadway and several avenues, and many of the miners are locating lots and building houses. It is estimated that next year its population will reach 5,000.

The number of edible vegetables and fruits that can be grown in the region is larger than at first supposed. Wild onions, rhubarb, blueberries, cranberries, salmonberry, wild raspberries and red currants grow in abundance on the sides of the mountains, and the Department of the Interior has just received from Mr. Ogilvie a bunch of wheat bearing the following card: "Grown at Fort Cudahy from accidental planting in the autumn of 1895. All from one root and cut 14 inches above ground, Sept. 7th, 1896." August 27th, min. temp, 31 8. August 31st, min. temp., 27.2; Sept. 1st, min. temp., 27.6. The wheat is not of the highest grade, but it is good nourishing grain.

The severe cold for so many months in the year seems to present the greatest ultimate difficulty, but Mr. Ladue says he has chopped wood in his shirt sleeves when the thermometer registered 70 degrees below zero and suffered no inconvenience.

Judge McGuire, who will preside over the courts of the Yukon district, was formerly a partner of the late James O'Reilly, in Kingston, and has for about twelve years been one of the judges of the Supreme Court of the North-West Territories.

A. E. Mills has gone from Victoria to Lake Teslin to erect a saw-mill there for F. M. Yorke, who also contemplates building a steamer on that lake.

A report from Lake Lyndeman, dated last month, says there are about 400 men on that lake and Lake Bennett building rough boats in which to descend the river to the Klondike mines.

NEAR THE HEADWATERS OF MILLER CREEK, YUKON DISTRICT.
From a Photo by Capt. Deville, Surveyor-General.

James D. McGregor, of Brandon, has been appointed inspector of mines for the Yukon, and is on his way to the Klondike.

On the authority of Hon. James Orr, the first member for Cariboo in the crown colony parliament of B.C., and John King, a Spokane miner, the B.C. *Mining Journal* gives the following as an easy pack route: Ashcroft to Quesnelle, 220 miles; Quesnelle to Fort Fraser, 140 miles; Fort Fraser to Decker Lake, 30 miles; Decker Lake to Hazleton, 75 miles; Hazleton to Kispiox, 9 miles; Kispiox to Stickeen above canyon, 90 miles; Stickeen above canyon to Teslin Lake, 120 miles; total, 684 miles, with good feed from the first of May until fall all the way. At no point is there a stretch of more than 20 miles without good feed. For hundreds of miles peavine is found in profusion, and blue joint stands along the lakes and water courses higher than a man on horseback in places. There are no high divides to cross, and good roads could easily be made from Quesnelle to Lake Teslin, on which route fresh horse feed can be had in plenty from 1st May to 1st November. The Hudson Bay Company turn out its "cayuses" all winter, and in the spring they are fat. They paw up the snow and get at the grass. In Lake Teslin salmon are captured weighing as much as 40

pounds. Grouse and pheasants are sometimes got, but the great game bird is the ptarmigan, of which countless thousands may be shot. The climate is not bad, and Mr. King knows families of white people who have lived n this route for 30 years and reared children. He says: "The man who goes to the Klondike by this route is exposed to few more hardships than in any new country. He can go nearly every foot of the way on train, steamer, horse and small boat. Once at the head of navigation, the man with an outfit can employ Indians to do the drudgery of camp life and will be sure of safe pilots. The Indians, Taltons and Stickeens get $2 a day and board. They do the cooking, set up the camp and perform all other duties.' It may be added that this route, as far as Telegraph Creek, has been used more or less ever since the days of the Cassiar alluvial mining days of 1870, and has been traversed by thousands of miners. Reports by the Government geologists show that all the regions bordering on this route are highly mineralized, and generally speaking have been scarcely touched on by the prospector The Canadian Pacific are now building a telegraph over this route The line starts from Quesnelle, on the main line, and runs north-westerly to Fort Frances, thence to Hazleton, then to Telegraph Creek, then to Lake Atlin (from which a branch will run down to Dyea), and from there to Fort Selkirk and Dawson City.

It is safe to say that the world will know more about the great North-West of Canada in the next six months than it has known in the past sixty years By each steamer newspaper correspondents are going north from Victoria, and from San Francisco, and Seattle, representing not only the leading Canadian papers, but American and European publications, including such papers as *Harpers'*, of New York.

A man named Johnson has come down to Vancouver with his partner, bringing $18,000 as the result of a strike this season on the Peace River, where they had been for three months working with pans and 12 foot sluices. Other miners were remaining there all winter, depending for their supplies on the H. B. Co.'s boats, and were taking out large quantities of gold with the crudest appliances. Owing to these finds it is proposed to organize a company, which will put new steamers on the Athabaska and Peace Rivers. The question of the route to the Yukon by these rivers and the Mackenzie is well treated in Edmonton *Bulletin* of Aug. 12th, in which two routes are considered cheap and practical, one being by way of the Pelly and the other by the Porcupine branches of the Liard River, starting from Athabaska Landing These routes have already been taken by a number of people from the North-West Territories. The distance from Edmonton to the Klondike is 1,400 miles as against 1,600 by the Chilkoot Pass and 4,400 by Behring Sea. A surveyor who has been over the route says one difficulty is the time lost in ascending the Yukon to the Klondike after going down the Porcupine, but such points will soon be determined; but meanwhile it may be said in favor of these routes that the discoveries of gold and other minerals this side of the Yukon—such as noted above—will render them attractive to the prospector. There may be more than one Klondike in the vast area of utterly unexplored country accessible from these routes. We can quite agree with the *Bulletin* that an all Canadian, all-land route, affording access to the north at all seasons, is the most pressing necessity if the wealth of this region is to benefit the trade of Canada.

W. T Jennings, the well known civil engineer of Toronto, is at the head of an exploring party whose mission is to determine the best route for a railway to the Klondike. Mr. Jennings is now reported on his way to the Stickeen. Meantime, an American party under W. A. Pratt, of Wilmington, Del., is projecting a railway for an American company.

The Alaska *Mining Record* has compiled a list of the amounts brought down by the miners during the present year, the total, including miscellaneous small finds, making over $6,000,000. The steamer "Portland," on her latest trip down to Seattle, brought gold-laden miners whose "piles" amount to a total at first estimated at $3,500,000, but which afterwards proved to be $575,000. Some of these returning miners declare that the half has not yet been told of the riches of the Yukon district A party has returned to British Columbia, reporting strikes on and around a creek near Klondike amounting to $160,000, but the finders are not disposed to give particulars. The most important information to hand since last issue is that brought down by Mr. Ogilvie, the Government surveyor, now on his way to Ottawa. He is reported to have made the calculation that 180 claims now worked on the Eldorado, Bonanza and Hunter's Creeks will, in three years, at their present rate of production, yield $70,000,000.

The London *Times*, in an article on the Klondike, says it is not easy to overrate the importance of the gold discoveries, which will prove a great incentive to the colonization of the Canadian North-West, because of the supplies of foodstuffs, etc., demanded by mining operations, and the fact that thousands who go out to mine will remain to settle on the lands. It was so in California, in Australia, and in South Africa, and will be so in Canada.

The Victoria *Colonist* mentions the following facts: In 1880 John McKenzie, a Canadian, with a party of Canadians, went down the Lewis River to Lake Lebarge. He was the first white man to run the White Horse rapids. He may be said to have discovered the route into the Yukon valley. The first discoverer of gold and mineral on Stewart River was a man named Fraser, from Nova Scotia. Franklin Gulch and Forty Mile Creek diggings were discovered by three Canadians named McCue, Stewart and Franklin. Davis Creek was discovered by a party consisting of one Canadian and four Americans. Miller and Glacier Creeks were discovered by a party consisting of Canadians and Americans. Birch Creek was discovered by a party consisting of three Canadians and two Americans. Klondike was discovered by a Canadian named Henderson.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The eighth annual convention of the Canadian Association of Stationary Engineers was held on the 19th and 20th August in the City Hall, Brockville, Ont. The first morning (Thursday) rain damped the hearty spirits of the delegates and put Brockville, as the entertaining city, at a great disadvantage. As a result the day's session was more fruitful in hard work than any other day in the history of the Association.

The delegates met about nine o'clock, and although seriously intent on work, about half an hour was spent in amusing reminders of the last convention. One incident was the presentation of an axe to President Devlin by Ald. McCrady. This had, no doubt, some timely significance, and though not on the programme, it evidently could not be described in the ordinary platitude as "a surprise to all concerned." The members were called to order at 9.30, and Ald. McCrady introduced Mayor Downey, of Brockville, who said he was pleased to have the privilege, as Mayor, of welcoming the engineers to Brockville, because he found that the objects of the association were praiseworthy. He continued: "If we look at any of our great factories, with hundreds of skilled operatives, guiding and directing machinery of many different kinds, which is driven by power derived from one central source, or at the waterworks or electric light system of a great city, we shall find the steam engine the source of all the power, controlled and regulated by a faithful and energetic man, on whose skill and integrity the successful operation of the whole elaborate system depends. How important then that the engineer should be a competent and trustworthy man, thoroughly skilled in all his duties, and I congratulate you and the public that your association devotes its energies towards securing the attainment of this most desirable end."

Then calling attention to the advantages of the town he said: "We have extensive manufacturing and other business establishments amongst us and also those various municipal improvements which mark a progressive nineteenth century town. Besides having an excellent system of water works and sewerage, our town is lit by gas and electric lights. We have commenced putting down granolithic sidewalks, and are looking forward to an electric street railway in the near future," and concluded: "Gentlemen, once more I welcome you to our town and invite you to feel at home in our midst, and I do most sincerely trust that your stay amongst us will be both pleasant and profitable, and will mark a step forward in the history of your association."

President Devlin thanked the Mayor on behalf of the delegates, said they would be pleased to welcome the Mayor and aldermen to any of the sessions, and invited the Mayor and Council to join the water party in the afternoon. Brief addresses then followed from the aldermen present.

After a few words from President Devlin, the Mayor and Council retired and W. F. Chapman read his address of welcome on behalf of Brockville, No. 15.

ASSOCIATION'S WELCOME.

Mr. President and Brethren:

On behalf of Brockville Subordinate Association, No. 15, C.A.S.E., it affords me a great deal of pleasure to extend to the Executive Council and delegates of the Canadian Association of Stationary Engineers, at this their eighth annual convention, a hearty welcome to our town. This is the first time that Brockville has been honored with a visit from the representatives of the large army of stationary engineers in the Dominion, and I trust that your brief sojourn with us may be both profitable and enjoyable, and that when you return to

your homes you will bear away with you pleasant recollections of the Island City of the St. Lawrence and of its people. While this association partakes largely of the character of a mutual improvement society, its chief object being the educating of its members to a higher standard of excellence in their work, still it is not without its social side, and the development of the latter along proper lines tends much towards the achievement of success in the former. During the eight years of the association's existence, excellent progress has been made, and the highly satisfactory results testify to the necessity that existed for such an organization which would bring together men engaged in the same occupation for fraternal intercourse and consideration of matters of interest to all. No one man knows it all in any one line of business, and it is only by free discussion and interchange of ideas that the safest conclusions are arrived at, and the best results are achieved. The position of the stationary engineer in Canada has greatly changed during the past few years. Previous to that time every man was working away along a line of his own, and knew little and cared less for what others around him were doing. Now this is all changed. At the meetings of our association difficulties which individual members meet with in their daily work are presented and discussed, and it is a knotty problem indeed for which a satisfactory solution is not found. In this way a large amount of theoretical knowledge is gained, which, added to the practical experience already acquired, makes every one who listens to or takes part in the discussion a better man. It is necessary to keep abreast of the age in which we live, and nothing helps more in that direction than frequent interchange of thought and close attention to what is going on in the world around us. While the members themselves thus reap a great advantage, their employers are also benefited, and much trouble and expense are often averted by the engineer knowing exactly what to do when a difficulty arises. In this way the association has begun a good work, which it is hoped it may long continue to carry on. Again, on behalf of the association I represent, I bid you welcome to Brockville, and extend to you the freedom of the town during your stay with us.

The roll was then called, the following members answering:

Toronto, No. 1—G. C. Mooring, James Huggett, Chas. Mosely, A. M. Wickens.

Montreal, No. 1—J. J. York, J. G. Robertson.

Hamilton, No. 2—Robert Pettigrew, Geo. Mackie.

Stratford—W. G. Blackgrove, John Fox.

Brantford, No. 4—Thos. Pilgrim, A. Ames.

London, No. 5—G. B. Risler, Wm. Gerry.

Ottawa, No. 7—Thos. Wensley, F. J. Johnston.

Dresden, No. 8—T. M. Steeper, Wm. Jamesen.

Kingston, No. 1—C. Selby, F. Simmons.

Kincardine, No. 12—Jos. Walker, Percy Ashton.

Wiarton, No. 13—J. F. Cody, Ed. Dunham.

Peterboro, No. 14—Fred. Donaldson, John Morency.

Brockville, No. 15—F. P. Andrews, C. Wilkinson.

Carleton Place, No. 16—Hugh McKay, W. J. Griffith.

Waterloo, No. 17—Chas. Uttley, Fred. A. Pflug, together with the Executive officers. District Deputies Granberg and Cody were absent. The following committees were then appointed:

Credentials—J. Huggett, Toronto; C. Selby, Kingston; Nathan Uttley, Berlin.

Constitution and By-Laws—J. J. York, Montreal; G. B. Risler, London; A. M. Wickens, Toronto.

Mileage—Jos. Robertson, Montreal; G. C. Mooring, Toronto; F. M. Steeper, Dresden.

Good of the Order—F. Simmons, Kingston; C. Mosely, Toronto; J. McKay, Carleton Place.

A lengthy discussion then took place on J. J. York's suggestion that the associations admit to every meeting bona-fide steam-users. Many employers seemed to think the C.A.S.E. was a labor organization, and to remove this error, he suggested that an invitation card containing the subject of the paper and name of reader be sent to steam-users every month.

President Devlin then read his opening address as follows:

I have the honor to welcome you to this our eighth annual convention. I am aware that in selecting you as delegates our various branches have sent their best men, consequently I am confident that your deliberations will result in the advancement of our organization, and that in dealing with the various subjects brought before you, the one and only aim sought shall be the greater good of the C.A.S.E. I am sure that naught but good-will shall prevail, indeed, such is one of the cardinal principles of our order. I need not ask for your hearty support, as this has always been given to the occupant of this chair. The committee appointed to act jointly with the C.A.S.E. to draft a bill seeking from the Dominion Parliament a law compelling engineers to pass an examination and hold certificates of competency, met in Toronto on March 17th last. The result of the deliberations and a copy of the bill will be laid before you. As you are aware, the bill received two readings in the House of Commons, and I am assured by the delegates who had charge of the legislation at Ottawa that, were it not for the lateness of the session, there would have been every prospect of the bill becoming law. The thanks of this association are due James Sutherland, M.P., for the kind reception of our delegates, and for his earnestness in endeavoring to have the bill become law. In this connection I should say that in this movement not only are the members of our association a unit in favor of such a law, but, I might add, almost all the qualified engineers of this country are with us, as well as most of the manufacturers and steam-users. During the past year some of our branches which had for some years shown want of vitality have been resuscitated. They are now possessed of fair membership, active and diligent in the work of the order, educational and social. London particularly is doing good work. On the whole our membership, however, shows a slight increase this year over last year. Guelph and Stratford, I am sorry to say, are not in a prosperous condition, and some effort must be made to infuse new life into these tardy branches. During the past year I can only report the establishment of one new association, that at Waterloo, Ont. It is to be hoped that during the coming year more advancement will be made in this regard. However, whilst our membership may not have materially increased in numbers, there has been greater care exercised in the selection of members, and the principles of the order have been most rigidly adhered to. I am most pleased to know that in some of the lodges the work is done with great precision, the use of the book of ritual being dispensed with by many of the presiding officers. The educational work, the great feature of the organization, goes on with greatly increased vigor and benefit to the members. During the year I had the pleasure of attending meetings at our two great centres, Montreal and Toronto. In both I was struck with the material progress visible and the facilities available to members by way of books, models, etc., whereby the educational benefits, so invaluable and important, are advanced. This feature of our association's work cannot be too highly appreciated. It may be necessary at the present convention to again take up the matter of bi-annual conventions, with a view to the curtailment of the expense necessary for an annual meeting. Steps should also be taken to arouse the engineers of the Dominion to the loss they sustain in not being of our membership. The provision made at last year's convention for the issuing of certificates of membership has been carried out. The matter of getting up a hand-book souvenir from which we expected to realize sufficient funds to meet the expenses of the convention has not taken practical shape, consequently, for this year at least, our old sources of revenue will have to be relied upon. Our worthy secretary and myself have been in correspondence for some time past, and he will lay before you very important information on the subject, which will be of great value when the postponed work is again taken up. Difficulties and persecution which I have encountered in common with others in the same employ have rendered it impossible for me during the past seven or eight months to give the active work to the accomplishment of the souvenir scheme which I had wished. Brethren, in conclusion, I desire to express to you my deep sense of gratitude for the great honor you conferred on me a year ago when you elected me to the high and honorable position of president of this association, and for the loyal manner in which you have stood by me. In closing, I will only add it is my heartfelt wish that your deliberations at this meeting may be so conducted towards each other that everything we shall do will redound to the benefit and honor of our good association.

Secretary Chapman then introduced W. H. Comstock, who offered the delegates the use of his steam yacht for a trip among the Thousand Islands. President Devlin tendered the hearty thanks of the convention to Mr. Comstock, and hoped he would allow them the privilege of electing him an honorary member, which was done.

The weather was so bad that the trip was postponed until

the next afternoon, on the understanding that the rest of the day be devoted to business.

President Devlin then announced an invitation from R. A. Bush, chairman of the Entertainment Committee, to visit the Brockville Asylum, of which he is chief engineer. This was declined owing to pressure of business.

An adjournment was then proposed by J. G. Robertson, seconded by W. G. Blackgrove, and carried.

The convention met for the afternoon session at 1.30. The appointment of auditors was the first business. They were J. Robertson, Montreal; F. Donaldson, Ottawa; Geo. McKay, Hamilton; F. P. Anderson, Brockville.

The report of the Committee on Credentials was presented and adopted.

Report of the Committee on By-Laws: J. J. York did not think it necessary to present a written report, as the articles permitted all that had been proposed with regard to hon. members.

J. Robertson asked: Is the C.A.S.E. incorporated? No? Well, the sooner the matter is taken up the better.

Vice-President Philip: Toronto, No. 1, was incorporated with power to appoint other associations. Toronto, No. 1, transferred all its powers to the Executive of the C.A.S.E.

J. Robertson: That is not the idea.

A. M. Wickens: The corporation was first called the C.A.S.E., and the present lodge is said to be located in Toronto. After running a year or two Toronto turned over her power to the C.A.S.E., and payment was made for all disbursements made by Toronto. He agreed that the C.A.S.E., as we now know it, should be incorporated, so as to act equally and legally in every province. Under a Dominion Act this would cost some $200, while the local Act cost $23.

J. Robertson: Montreal is incorporated under the laws of the Province of Quebec, but still it is local. Now the simple act of Montreal turning over its power to another association does not mean that the other association is incorporated.

Vice-President Philip: In asking for incorporation you have to state the names of those composing the proposed corporation, and the place where the office is. But fifteen minutes after incorporation you can change the personnel. This is all that was done by Toronto, No. 1. However, a Dominion Act would be better.

Jno. Murphy: When the C.A.S.E. was formed it took over the charter and seals of Toronto, No. 1. That charter is in the possession of the C.A.S.E.

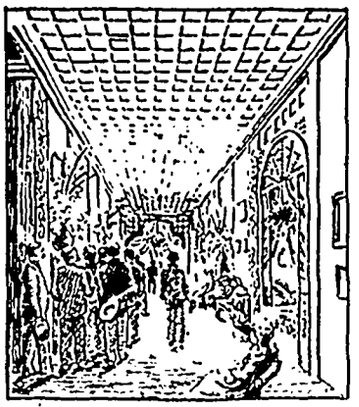
J. J. York: When I was Executive secretary, I made an attempt to draw a line between Toronto, No. 1, and subordinate associations. I never saw a charter of any description—nothing but the blank lithographed form which is filled in for subordinate associations. There was no seal until I got one made. I never heard of a sealed charter.

At this point Ald. McCrady entered and said that as the weather seemed to be settling for fine, he would procure rigs to take the party to the asylum, if it were agreeable to them.

C. Mosely proposed, and J. Robertson seconded, that all reports be deferred till the next day.

President Devlin then made a few remarks respecting legislation. He had not yet heard from the delegates, but it was said that opposition was coming from Quebec. The delegates from Quebec are here, he said, and the delegate to the Ontario Government (A. M. Wickens) is also present. A. M. Wickens said that at the second reading of the bill there was a strong opposition by the French members. He strongly advocated a Dominion law. Chas. Mosely suggested that this matter be left to the Committee on the Good of the Order. F. Simmons moved that J. J. York and J. Robertson, of Montreal, and A. M. Wickens, the deputy to the Ontario Government, be added to the Committee on the Good of the Order. This was seconded by C. Mosely and carried.

The convention then adjourned for the trip to the asylum. The party drove past Brockville's most beautiful homes, some of them belonging to men whose names are known to the English-speaking world. One of the most charming was that of Major Walsh, who within a few days will start for the rigorous Klondike region, there to exercise the function of Governor over a hoard of sturdy men such as only a mining boom can gather together. The party was received at the Asylum for the Insane by Dr. Murphy and staff, and conducted round the wards by Ald. O'Brien. These wards are winning in appearance. They are constructed on a light, airy plan, and decorated with an elegance calculated to subdue all grossness and inspire a habit of placid contentment, as useful to the sane engineers as it was necessary to the deranged inmates. Notwithstanding the deep sympathy that was generally felt for those whose liberty was restrained for apparently so light a reason, the visit acted as a pleasant and wholesome pause to the hilarity which



CORRIDOR IN THE ASYLUM FOR THE INSANE BROCKVILLE.

belongs to the convention. After visiting the kitchen, laundry, engine-room and pumping station, and congratulating R. A. Bush on the condition of his boilers and machinery, the party drove on to the fire and electric light station. On the return to the St. Lawrence Hall, Ald. McCrady gave an alarm of fire. The fire station was a quarter of a mile away, but in the space of one minute 50 seconds the hose was throwing its full stream of water in front of the hotel and far higher than its roof. Snap-shots were taken by Vice-President Philip of the firemen, engine and horses, and they departed amidst the hearty cheers of the delegates.

The delegates gathered for the evening session at 7.30. Ald. McCrady introduced Ald. Cash, Thompson, and the chairman of the Board of Works, E. A. Buchman. F. Simmons presented the report on the good of the order, which proposed that the holding of the convention bi-annually be considered at this meeting. It recommended that a committee be composed of one man each from Toronto, London, Ottawa, Montreal, and Kingston, to take up the work of legislation, and carry it through without delay, and that these men be appointed by their respective lodges. It also recommended that the subordinate lodges be requested to create as many hon. members as possible from among steam-users. The discussion of this was taken up later on.

A. M. Wickens was then called upon for his paper on the C.A.S.E. He had not written a paper, but proceeded with an interesting address. He said in effect: One of the most vital things to the organization is to keep up the interest during the convention. The lodges should be well represented, and

"GRANDPA" ON THE C.A.S.E.

the programme of business adhered to rigidly. We ought to be making more rapid strides than we are doing. This association is unique in its general laws and working. The foundation is education and our mottoes are Safety, Economy, Re-

liability. It is purely an educational society, and the members spend their own money in educating themselves. An engineer can save his employer much money, and he is entitled to a share of that, and indeed, sometimes gets it. Since the object of the association is to educate engineers up to this point, we should leave no stone unturned to secure the membership of capable men, who are interested in the object. Too many men get interested for a time, and then fall out. He thought that the best way to secure interest in the general meetings would be to get live secretaries. Those who have acted have done their best, but it has been for love. Why not pay the secretary a little for his trouble? This would considerably strengthen his hands. There are 4,000 engineers in the Province of Ontario, but they are so scattered that it is difficult to get them together. Many of the towns have so few plants that there are not enough members to make a branch and rent a room. From the successes that we have made in educating young men we should naturally think that we have more good men in the organization than appear. It takes money to run a branch, and the secretaries are sometimes to blame for not looking after the subscriptions. Then the Executive secretary should keep in close touch with all the branches by writing to them every month and telling them of the progress made by other branches. We could start a set of questions to be sent to all the branches. An extra movement should be made this year to interest steam-users in the coming legislation. This could be done by inviting them to the local meetings.

As the papers to follow were likely to initiate discussions he would now give way to them.

G. B. Risler, of London, then read his paper on "The Use of the Indicator," followed by Vice-President Philip's paper on "The Use of the Tower for Condensing Purposes." Having finished reading the paper, Vice-President Philip added that he recently had the pleasure and profit of installing a cooling tower. When you have to buy water for feeding the boiler the cost renders it out of the question. Then the cooling tower is an advantage. One is used at O'Keefe's brewery. Water is pumped to the top of a tower, which has some filling, wood, tile, or wire, which spreads out the water in falling. The temperature is thus reduced, and the water can be used again. The process evaporates a certain amount of water, and this produces a reduction in the temperature of the surrounding air, which will condense another pound of water. The plant that he was most familiar with was of 500 h.p. capacity. It is a surface condenser. It has 6,400 ft. of tubing, and 1,600 stuffing boxes. The tower is 19 ft. high, and the filling is 11 ft. long. The water goes up at a temperature of 120 deg., and when it reaches the bottom of the tower it is at 68 deg. This is a subject of vital importance to engineers, for as the coal bill keeps creeping up, condensing is one of the best ways of reducing the quantity of coal.

W. F. Chapman: Is the plant expensive?

Vice-President Philip: The tower, piping and condensing cost $7,000. Where there is a yard a jet condenser can be used, and thus lessen the cost.

H. McKay: How long does it take to show the saving?

E. J. Philip: The saving is a net 15 per cent. on the coal bill.

H. McKay: What is the loss of water during evaporation?

E. J. Philip: There is an overflow of water from the top of the tower all the time. But with the cooling tower you can use less water than when not condensing.

J. Murphy: Is not a simple-acting pump much more economical than a duplex?

E. J. Philip: A simple-acting vertical bucket pump is, because the valves close so rapidly. The ordinary horizontal pump is the least economical.

J. Murphy had had some experience with both vertical and horizontal pumps. The vertical in these cases were under some disadvantage certainly, but he had more trouble with the vertical than with six or seven horizontal. His was a Blake condenser.

E. J. Philip: That must be an exceptional experience.

J. J. York hoped that in the near future Bro. Philip would let them have some accurate data on the saving. He did not at present see much saving. Manufacturers must see a larger saving than 15 per cent. before they would lay thousands of dollars in a plant. What is the chief injury to boilers using copper tube condensers?

E. J. Philip: The best evidence is that given by the British Admiralty reports on the British war vessels. The chief trouble was corrosion. In some boilers it eat out along the seams, and sometimes all along the boiler.

J. J. York said he used a great many copper feed pipes and never noticed any matter in the boiler.

E. J. Philip: Well, you don't get much copper piping now. It is not pure copper, and has much brass in it.

J. Robertson, on being asked for his experience with copper piping, said it was with a cooking apparatus run by a small locomotive boiler. He noticed that after two or three months the boiler began to pit. He concluded that the copper had something to do with it, so he run the water into the sewer and found no more pit. He asked would Bro. Philip use the condensing tower in the winter.

E. J. Philip: Yes. Though it is slightly more costly.

J. J. York moved, and J. Murphy seconded, a vote of thanks to the readers. This was adopted and conveyed.

The discussion on the recommendations of the Committee on the Good of the Order was then resumed.

Chas. Mosely proposed, and J. C. Mooring seconded, that the conventions be held bi-annually. J. Robertson sympathized in many ways with the proposal, but two years was too long. A quorum would not be obtained after so long an interval. J. J. York agreed. Each year the attendance is less satisfactory. As it is, there is not enough business done. It would be better to continue as they were. He was much in favor of a paid secretary with defined duties, for this very reason, C. Mosely moved and J. C. Mooring seconded, that the conventions be held bi-annually, unless the laws now before the Ontario Legislature be passed this session. Motion lost.

During an interval the Committee on Mileage presented their report. The actual sum expended was $191.55. The adoption of this report was moved by A. M. Wickens and seconded by C. Selby. The secretary's and treasurer's report showed the finances to be in a very healthy condition, having a larger balance than in any previous year. The adoption of this was proposed by J. C. Mooring, and seconded by J. Murphy.

President Devlin, who had returned to the chamber, proposed a vote of thanks to the Royal Oil Company, who had presented the C.A.S.E. with the sum of $10, per D. Reeves. J. Robertson then presented the auditors' report. Everything had been found satisfactory, and the book-keeping a credit to the organization. Its adoption was proposed by J. J. York and seconded by J. Huggett.

President Devlin then brought up the question of the souvenirs. This, it will be remembered, was to take the form

PRESIDENT E. J. PHILIP.

of an engineer's pocketbook. Letters were read by the secretary from two or three publishing firms who had been invited to tender for the same. E. J. Philip moved, and J. Murphy seconded, that this matter be left in the hands of the Executive, and that it is expected to have taken practical form by the next meeting.

J. J. York moved that the present secretary, F. W. Chap-

man, be tendered $25 for his services during the past year. This was seconded by J. Robertson, and carried.

The meeting was then adjourned till the following morning.

Friday.—The delegates gathered soon after nine o'clock They had done good work the previous day, and this morning it was difficult to settle down. The first business was the appointment by President Devlin of the scrutineers, who were J. Fox, F. Robert, A. McCallum.

J. J. York then proposed that one ballot be cast for the office of president. This was seconded by J. Murphy, and E. J. Philip, of Toronto, was elected. By the same process F. W. Chapman, of Brockville, was elected vice-president, F. W. Robertson, of Montreal, secretary, and R. C. Pettigrew, treasurer. President Devlin nominated J. C. Mooring as conductor. J. Robertson nominated G. B. Risle . The ballot cast resulted in the election of G. B. Risler. J. J York nominated and J. Robertson seconded J. C. Mooring as door-keeper. He was elected without ballot.

The next place of meeting was then to be chosen. R. C. Pettigrew announced an invitation from Hamilton. J. Murphy proposed, and G. B. Risler seconded, that the invitation be accepted. W. G. Blackgrove announced the invitation of Berlin, and J. Robertson proposed London. The ballot resulted in the choice of Hamilton.

Conductor Murphy was then instructed to fetch in the caretaker, Michael Sullivan. On his appearance the president presented him with a $5 bill as a consolation for the trouble the convention had given him. The next business was the installation of the newly-appointed officers. A. M. Wickens was asked to act as grand conductor, and the most recent past-president, W. G. Blackgrove, initiated the officers, and presented each with the insignia of his office. On taking his seat President E. J. Philip, of Toronto, appointed J. Robertson, of Montreal, and W. G. Blackgrove, of Toronto, to act as district deputies.

Mayor Downey was then introduced, and after one of the little speeches, which ensured his popularity with the engineers, presented Past-President Devlin with a jewel of the customary design and value. Past-President Devlin returned thanks, and promised to devote himself to the interests of the association in the future, as he had done in the past.

J. Robertson then moved, and W. G. Blackgrove seconded, a hearty vote of thanks to the Mayor, Council and citizens of Brockville. The Mayor, in reply, said that he would be indeed a cold-hearted man who did not appreciate such treatment as he and the citizens had received. C. Selby proposed, and J. Murphy seconded, a vote of thanks to Ald. McCrady and O'Brien and other city officials.

P. P. Devlin proposed a vote of thanks to the local press of Brockville. A. M. Wickens, in seconding, said that at no convention had they received better reports.

Mr. Laidlaw, of the *Recorder*, thanked them, and said that if they ever returned to Brockville he for his part would be ready to repeat the operation.

J. Robertson proposed, and J. Murphy seconded a vote of thanks to THE CANADIAN ENGINEER.

J. Robertson moved, and J. J. York seconded a vote of thanks to the retiring officers.

The convention then adjourned to display itself before the photographer.

Afternoon.—At two o'clock the "Albani," Mr. Comstock's yacht, steamed out of Tunnel Bay with the engineers and their friends, accompanied by Mayor Downey and Councillors W. J. Wright and McCrady. The "Albani" ran up to Alexander Bay, where a stay of about half an hour was made. A plentiful lunch was provided on the return trip, after which a very hearty vote of thanks was tendered to W. H. Comstock, on the motion of A. M. Wickens and P. P. Devlin.

The party reached home about 7.15 p.m., and left the dock cheering the captain and engineer of the "Albani." The engineers then repaired to the Council chamber, where J. J. York proposed, and A. M. Wickens seconded, an expression of sympathy for A. E. Edkins, of Toronto, who was prevented by illness from being present.

A. M. Wickens proposed, and J. J. York seconded, a vote of thanks to the Brockville Association, coupling with it the name of R. A. Bush. Ald. McCrady briefly replied, and the convention proper came to an end. The delegates were then escorted by the Island City band and flambeaux back to the St. Lawrence Hall, where at 9 o'clock a dinner was tendered to the delegates by the Brockville branch.

Shortly after nine the delegates and their friends filed into the banquetting hall, and in all about 70 sat down. The Rev. J. C. Sycamore said grace. After the eating interval the toast list was entered upon.

The first toast was, of course, "The Queen," which was accorded the usual honors. The others were as follows: "Canada, Our Home," responded to by the Rev. J. C. Sycamore, ex-Mayor Derbyshire, and Town Clerk McMullen.

"Brockville, the Island City," responded to by Mayor Downey, Ald. McCrady and O'Brien.

"The Manufacturers," coupled with the names of Mr. Geo. Nicholson, of the James Smart Mfg. Co, and Bro. F. G. Johnson, of F. G. Johnson & Co., Ottawa.

"Kindred Societies," responded to by F. Lawrence, D. Reeves, W. J. Jento, and A. M. Wickens.

"The Executive" was replied to by P. P. Devlin, President Philip, Treasurer Pettigrew, Conductor Risler, and Door-keeper Mooring.

"The C.A.S.E." was responded to by J. J. York, W. G. Blackgrove, F. Simmons, F. P Andrews, and Jno. Fox.

"The Press" was responded to by Mr. Spurrier, of THE CANADIAN ENGINEER; Mr. Healy, of the *Times;* and Mr. Laidlaw, of the *Recorder*.

"The Local Association" was responded to by W. F. Chapman.

"The Ladies" was responded to by J. Robertson, and "Our Host" by Horace Robinson.

Songs were contributed by W. G. Blackgrove, whose admirable voice would be sorely missed, and Frank Roberts, and Tom Daly's recitations won very hearty applause. The National Anthem was sung, followed by the joining of hands and the singing of Auld Lang Syne.

This convention, although short, consisting of only four sessions, will probably be remembered as a business one. This was largely owing to the exertions of J. J. York and two or three of the older members. Legislation when effected will greatly strengthen the hands of the association, and benefit the users of steam. The motion for a paid secretary, and the earnest desire that the Executive should be in continual correspondence with the subordinate associations, will no doubt have the effect of increasing the enthusiasm of individual members and holding their interests; and the desire to get the manufacturers to prove the objects of the association by personal attendance at their meetings, is a sufficient answer to the false impression that the C.A.S.E. is a labor organization.

G. B. RISLER.

G B. Risler was born in Switzerland in 1858, and in his early days had a great liking for machinery, but going out in the world when but 14 years old to find his own living, he had not the desired opportunity to learn his trade as a mechanic. He soon began the firing of steam boilers, and became now and then assistant in the engine room. In 1884 he emigrated to Canada, and was employed for a number of years as sawmill engineer, and in a woolen mill in the same capacity. In 1891 Mr. Risler was engaged by the London, Ont., *Advertiser*, and is yet their engineer. He has been president of the London branch of the C.A.S.E., and has been very active in promoting the interests of the society. Among other evidences of the sincerity of his words is the

fact that Mr. Risler has prepared and had printed at his own expense a series of examination questions, for correct answers to which he has also offered prizes. The date up to which answers to these questions can be sent to compete for the prizes is September 19th. Mr. Risler is one of the most progressive members of a progressive organization.

NEW SYSTEM OF FILTERING IN USE IN A NUMBER OF GERMAN CITIES.

The State Department at Washington has received an account of a new system of filtering water intended for city use, which should be of interest to the authorities of many municipalities struggling with the problem of purifying river water on a large scale for household and manufacturing purposes.

There is now in operation at the city of Worms, as well as at Kiel, Winterthur, and at several other places in Germany, an improved system of filtering water, known as the Fischer system. Hitherto the method most generally employed has been that of filtering through sand or gravel, and for this purpose a layer thirty to forty inches thick of clean sand, mixed in some cases with charcoal, has been used. The sand being loose and non-adhesive, entails two important economical disadvantages; First, the area of space required is large in proportion to the amount of water to be treated, and, secondly, all sediment in the water settles upon the sand, which forms the bottom of the filter, and which soon becomes gorged and clogged, so that the filter must be thrown out of use while it can be cleaned by mechanical means.

The new system now in use in the city of Worms is the invention of Director Fischer, for many years past water works engineer at that city, where the use of Rhine water for general purposes presents the same problem that confronts cities like Cincinnati, St. Louis and Brooklyn. The fundamental idea upon which the new system is based is the fact that clean, sharp sand, when mixed in due proportion with finely pulverized glass, forms a porous mass which, by baking under a high pressure, may be hardened in any desired form. The inventor in this case hit upon the plan of molding this porous mass into hollow plates or plaques, about forty inches square and eight inches thick; that is, with walls three inches in thickness and with about two inches of hollow space in the centre of the plaques. In constructing the filtering plant these plates are set upright in groups of batteries of any number, according to the desired size and capacity of the establishment, and are arranged along the lower portion of one or more tanks of hydraulic masonry, where they can be covered to a depth of three or four feet with the water to be filtered. Being then submerged the water is forced by its own pressure through the porous walls of the plate into the interior hollow space, where it trickles down, and is drawn off through pipes laid at the bottom of the tank to the reservoir, which receives the filtered water. These discharge pipes are rigged with cocks so that each plate and group of plates may be isolated for cleaning purposes, while the adjacent batteries are in operation. For greater economy of space and tubing two tiers of plates are set up, one above the other, whereby both tiers are served by one set of discharge pipes. The water in passing through the three-inch walls of vitrified sand is filtered as perfectly as by traversing three feet of loose sand or gravel in the ordinary sand filtering process. The plates, being set upright and close to each other, increase from eight to ten-fold the filtering surfaces that may be condensed within any given superficial area, thus securing an improved economy of space within frost proof structures.

According to an official report of M. Jansen, of the University of Berlin, who made an exhaustive study of the whole subject at Worms, that city began in 1889 to filter the Rhine water for general purposes by the ordinary sand filtering process. With a filtering surface of 13,000 square feet, 792,000 gallons of water were filtered in twenty-four hours. This supply proved insufficient for the city, and it became necessary to construct an addition to the filtering plant, the cost of which on the sand filtering plan, was estimated at $30,000. Instead of occupying new lands and building additional structures, one of the ten vaults containing the sand filters already in use, was isolated, cleaned out and the space filled with a battery of 500 plates of the Fischer pattern. The whole cost of the change thus made was about $9,600, and the new filters occupying one-ninth as much space as the sand filter, doubled the filtering capacity of the entire installation.

THE DEEP WATERWAY FROM THE GREAT LAKES TO THE HUDSON RIVER.

The Secretary of War has transmitted to the United States Congress the report of the chief of engineers on the preliminary examination made by Major T. W. Symons, of the Corps of Engineers, U. S. Army, of a ship canal from the great lakes to the Hudson River. The work was done in accordance with a provision in the last River and Harbor bill, directing the examination and calling for estimates of the cost of construction of the most practicable route of such a canal, wholly within the United States, of sufficient capacity to transport the tonnage of the lakes to the sea.

General Wilson, Chief of Engineers, says in the report that it is the opinion of the local officer that the best route for a ship canal is that by way of Niagara River, Lake Ontario, Oswego, Oneida lake and the Mohawk and Hudson rivers, and that this would cost, at rough estimate, $200,000,000. But Major Symons is also of opinion that the Erie canal, when enlarged under the existing plans of the State of New York, would, if the restrictions imposed by the State upon its use be removed, give commercial advantage practically equal to the commercial advantages of a ship canal. Major Symons' says the ship canal is not a project worthy of being undertaken by the general government for the reason that its benefits would not be commensurate with its cost. If this can be further improved by enlargement to a size sufficient for 1,500-ton barges, making the necessary alterations in its alignment so as to continuously give a descending canal all the way from Lake Erie to the Hudson River and canalizing the Mohawk River, Major Symons says, such an improved canal, navigated by barges, would enable freight to be transported between the East and the West at a lower rate than by ship canal navigated by large lake or ocean vessels, and he states that the enlargement of the Erie canal as suggested, with everything adapted to transport the tonnage of the lakes, is a project worthy of being undertaken by the Government, as the benefits derived would be commensurate with the cost, which is estimated approximately at one-fourth that of a ship canal.

Gen. Wilson says that owing to insufficiency of the appropriation only ordinary preliminary examination was made. He says Major Symons, who made the examination, found three possible routes for a ship canal, wholly within the United States. The first extends from Lake Erie via the Upper Niagara, to the vicinity of Tonawanda or La Salle; thence by canal with locks to the Lower Niagara, at or near Lewiston or some point on Lake Ontario; thence through Lake Ontario to Oswego; thence up to Oswego and Oneida River to Oneida Lake, through Oneida Lake; thence across the divide to the Mohawk, and down the Mohawk to the Hudson at Troy. This is designated as the Oswego route, and is the one Major Symons thinks the most practicable.

The second route follows the line of the Erie canal from Lake Erie and the Niagara River to the Hudson.

The third coincides with the first from Lake Erie to Lake Ontario, running thence through Ontario to the St. Lawrence River, and down the St. Lawrence to some point near Ogdensburg; thence crossing the State of New York to Lake Champlain and up to its head; thence following in general the route of the Champlain canal to the Hudson at Troy. While Major Symons mentions this as a possible route, he is of the opinion that it is not a practicable one.

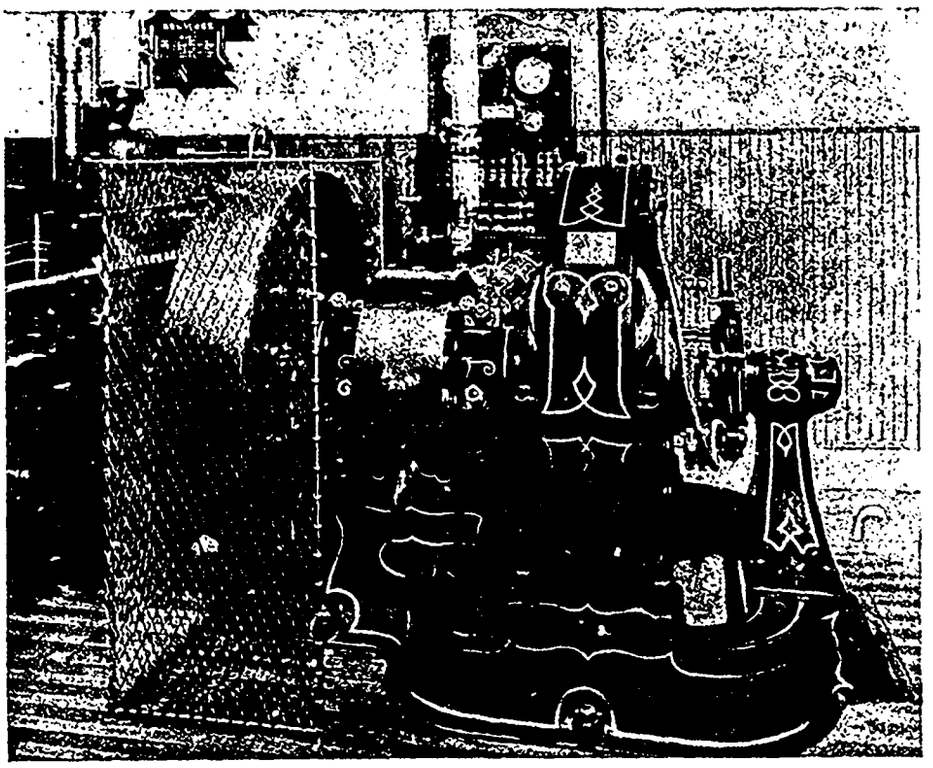
Allusion is also made in the report to still another route, the St. Lawrence-Champlain route, all of which, except a small portion, is in the United States.

The rough estimate, $200,000,000, covers any of the possible routes mentioned. But this estimate, says the report, depends to a very great extent upon the action of the State of New York in regard to its canals, feeders, reservoirs, etc. To maintain such a canal, operate the locks, keep it in repair, etc., would cost at a rough estimate $2,000,000 a year. Such a canal, if constructed, would, the report says, have no military value. Major Symons is of the opinion, says the report, "that the construction of such a canal is not a project worthy of being undertaken by the Government, as the benefits to be derived therefrom would not be properly commensurate with the cost." The cost of the necessary surveys for a ship canal along the Niagara-Oswego route is estimated at $190,000, an entirely independent survey for the enlargement of the Erie canal, $125,000, a combined survey of both, $250,000. In trans-

mitting Major Symons' report the divisions engineer, G. L. Gillespie, says: "The subject of transporting the tonnage of the lakes to the sea is exhaustively treated in this report, and the facts stated and the arguments thereon relative to the methods to be followed are worthy of the closest study by Congress." No definite conclusions and recommendations can be given relative to location and methods of construction, he says, until after the suggested surveys have been made.

THE O'KEEFE BREWERY COMPANY'S ELECTRICAL PLANT.

The Canadian General Electric Company has recently installed for the O'Keefe Brewery Company (Limited), Toronto, what is probably the most complete isolated electrical plant installed up to the present in any manufacturing establishment in the Dominion. The generator consists of a 25-kilowatt steel frame machine, direct connected to an Ideal engine, running at 305 revolutions per minute. The design and construction of the apparatus are such, it is claimed, as to secure the highest possible efficiency, combined with the greatest durability in service. The frame and pole pieces are cast from a specially selected



soft steel of the highest magnetic permeability. The construction of the armature is such that currents of air circulate constantly through the core, windings and commutator, ventilating them perfectly. The armature windings are straight copper bars, requiring but two joints for each convolution rendering short circuits and similar troubles practically impossible, and facilitating any repairs which might become necessary on account of mechanical injury. The insulation of all the machines of this type is of the best, combining great mechanical strength and durability with high spark resisting qualities. The increase in temperature up to full load is kept exceedingly low, and the use of carbon brushes insures absolute freedom from sparking under all conditions of load. Since starting up, this unit has shown itself to be entirely satisfactory, requiring practically no attention whatever and being perfectly smooth and noiseless in operation. The switchboard consists of a dark marble panel, upon which are mounted the necessary switches and Weston instruments. A triple pole, double throw switch is used to connect the installation with the three wire mains of the Toronto Incandescent Light Company, at such times as it is not desired to keep the plant in operation. The engine and dynamo has been artistically painted to conform with the finish of the other machinery in the engine room of the O'Keefe Company, and altogether the installation is one which reflects the highest credit upon the manufacturers, as well as being a source of satisfaction to the O'Keefe Company. It might be added, that besides the lighting of the brewery, current is furnished to operate several small motors from which fans, ventilators, etc., are run throughout the buildings. The substitution of electric motors for the small steam engines formerly used for this purpose has been at once a great gain in convenience and an important saving in fuel.

THE SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

The annual meeting of the Society for the Promotion of Engineering Education met at the School of Practical Science, August 16th. Henry T. Eddy, of the University of Minnesota, president, occupied the chair.

Among the prominent members present were John Galbraith, School of Practical Science, Toronto; John M. Ordway, Tulane University; John J. Flater, Purdue University, Lafayette, Ind.: C. Frank Allen, Massachusetts Institute of Technology, Boston; Frank O. Marvin, Joseph P. Jackson, Mansfield Merriman, Harry W. Tyler, Ira O. Baker, D. C. Jackson, John B. Johnson, William Kent, Albert Kingsbury, A. Kingsbury, L. S Randolph, Stillman W. Robinson, Robert H. Thurston, Carl L. Mies, W. G. Raymond, Cady Staley, Robert S. Woodward, Arthur Beardsley, Robert Fletcher, Thomas C. Mendenhall, William H. Schnermann, M. E. Wadsworth.

In his opening address, Dr. Eddy, as president, dealt with engineering education as it is and as it ought to be. He referred to the development of the profession of engineering during the present generation into a place in public estimation as a learned and responsible profession, like law or medicine. Dr. Eddy contended that engineering courses should be completely professional. Two kinds of study interfere with each other, and "culture" studies must disappear from engineering classes. An engineer should obtain his knowledge in those studies preferably before entering upon the study of engineering. Tangible and practical studies were strongly advocated. Organization of the profession and education in the law of contracts were also dwelt upon as very necessary.

After the conclusion of the president's address a paper on "Methods of Teaching," by W. H. P Creighton, was read. "The Calculus for Engineering Students," by F. W. McNair, completed the morning session. At the evening session "The Teaching of Machine Design," by J. J. Flater, opened the session. This was followed by "The Influence of Scientific Research upon the Development of Chemical Technology," by H. Bunte; "Chemical Engineering," by J. M. Ordway; "The Efficiency of Technical as Compared with Literary Training," by T. C. Mendenhall, which called for considerable discussion; "A Course in French and German for Engineers," by A. N. Van Doell, and "At What Point should Students Engage in Scientific Research and How Much Aid should they Receive from the Professor," by C. D. Mark, completed the day's programme.

At the second day's session the morning was devoted largely to the disposal of routine business. The paper on "Mining Vacation Fieldwork," which was promised by Dr. F. W. Denton, professor of mining engineering in the University of Minnesota, and that on the subject, "To what extent should metallurgy be taught in mechanical engineering courses?" promised by Dr. M. E. Cooley, professor of mining engineering in the University of Michigan, were not presented. "At what point should students engage in specific research, and how

much aid should they receive from the professor?" was the subject of a paper by Prof. C. D. Marx, who said that the inferiority of the instruction in American engineering colleges, except in the laboratories, was due to inferior preparatory training and the lack of teachers who combine theoretical training with wide practical experience. "The average American teacher is overburdened with work sufficiently to prevent giving efficient assistance to the few who take the fifth year and research work. The work of research is itself desirable if undertaken as post-graduate work and under proper conditions. For success in this work, the professor must have the proper training in addition to practical experience, and must be allowed sufficient time for this special work. Present salaries are not calculated to secure many such men, nor are they allowed time for such work. Student's work in research should follow, not precede, research work on the part of the professor." In the afternoon, the members of the society inspected the laboratory in the School of Practical Science and pronounced themselves highly pleased with the completeness of the equipment which the department possesses. Later in the afternoon the members assembled at Prof. Loudon's residence and were guests at the garden party to which they and the members of the Mathematical Society had been invited.

Professor C. M. Woodward read a paper on "Manual Training for Artisans." He pointed out that manual training was neither manual labor nor trade training. Manual training was purely educational, differing from the methods of ordinary workshops or of a trade school. Manual training is an excellent thing for an artisan, as for everyone else. It makes the learning of a trade a very simple and easy matter if one wishes to be a mechanic for a time, but the graduate of a manual training school will probably not become an artisan at all in the ordinary sense. The records show that a great majority of graduates earn more money and achieve greater success in other occupations. If you wish your boy to be a mechanic do not send him to a manual training school; if you do he may become an architect, an engineer, a lawyer or a physician. Prof. Thos. W. Mather read a paper on "Manual Training in High Schools." He said that two courses of instruction should generally be given in a manual training High School The first should afford preparation for colleges or schools of technology, while in the second it may be assumed the boy's school education must end upon graduation. During the third year a period every day should be given to elementary mechanics experimentally treated. In the fourth year an equal time should be devoted to applied mechanics treated in the same way. This may profitably include heat, steam and the steam engine, the strength of materials and stresses in structures.

Dr. C. S. Murkland read an interesting paper on "Agricultural Colleges, their Function, with Relation to Engineering."

At the close of the meetings the following officers were elected:—President, J. P. Johnston, Washington University; vice-president, T. C. Mendenhall, Worcester Pyrotechnical Institute, and Harry W. Tyler, Massachusetts Institute of Technology; secretary, Albert Kingsbury, New Hampshire College of Agriculture; treasurer, J. A. Flater, Purdue University, Indiana.

THE AIR SHIP IS HERE.

On the 13th of August, at Vancouver, an object was seen in the sky travelling eastward, which had all the appearance of an air ship, and what was said to be a balloon was reported at three or four different points in Manitoba and the territories. At 12.40 on the morning of the 16th, C. W. Spencer, superintendent of the Eastern Division of the C.P.R., was sitting with Thos. Hay, his assistant, in the observation car of the train which had left Port Arthur for Sudbury, and as they were approaching Gravel River, and sat admiring the clear starlit heavens, they saw, in the words of Coleridge, "a something in the sky." There was a large white light, and at an angle above it on the left a red light and at a like angle on the right a white light. The object appeared to be about half a mile above the earth, and when first seen was at an angle of 30° to 40° above the horizon. It seemed to be moving with the wind about 30 miles an hour, as the train was running at 45 miles an hour, and the object appeared to fall in their wake. When they had watched it about three minutes the train turned inland from the shore of Lake Superior, and before it was hid behind the bluffs it tilted and turned inland, apparently following them up valley. As it turned the red light became blue, and there was disclosed in line with the main headlight a row of four lights terminated by a circle or ellipse of a dozen lights, in the midst of which was the dark body of the air ship. The light had the steady clearness of electric or acetylene light, and Mr. Spencer and Mr. Hay could form no other opinion than that it was an air ship, and if the object seen at Vancouver was the same it must have travelled to this point, 2,100 miles, at the rate of about 700 miles a day. It is quite possible that some inventor has set to work quietly and unostentatiously, and thus put his theories in practice before announcing his discoveries to the world; and if he has not since come to grief in the wilds north of Lake Superior, we shall soon know that air navigation has been first accomplished on Canadian territory.

THE LATE F. B. ROBB.

The late F. B. Robb, secretary-treasurer and manager of the Robb Engineering Co., Limited, who was drowned while bathing at Fox Harbor, N.S., July 20th, was born at Amherst, Nova Scotia, on the 8th of November, 1857. His father, the late Alexander Robb, was one of the pioneer manufacturers of Nova Scotia, having established in 1848 the business which has since developed into the Robb Engineering Co. Mr. Robb was educated at the Cumberland County Academy and Dalhousie College, Halifax, afterwards being specially fitted for his work by a short experience in banking and a commercial college course at St. John. In 1876, when nineteen years of age, he, with his brother, D. W. Robb, now president and engineer of the company, took the full management of the extensive business in which he labored up to the time of his death.

METAL IMPORTS FROM GREAT BRITAIN.

The following are the sterling values of the metal imports from Great Britain to Canada for July, 1896 and 1897, and the seven months ending July, 1896 and 1897:

	Month of July.		Seven months ending July,	
	1896.	1897.	1896.	1897.
Hardware and cutlery	£4,032	£5,825	£36,143	£37,755
Pig iron	2,416	942	12,282	3,807
Bar, etc.	1,068	786	9,569	5,799
Railroad	40,614	17,368	88,089	37,654
Hoops, sheets, etc.	8,968	8,313	25,110	31,003
Galvanized sheets	7,625	6,083	30,979	25,458
Tin plates	9 681	5,987	77,235	94,942
Cast, wrought, etc., iron	3,522	1,943	29,625	19,277
Old (for re-manufacture)	2,496	1,080	11,422	2,577
Steel	10,778	6,099	55,185	29,537
Lead	950	3,699	8,506	10,959
Tin, unwrought	1,796	345	9 510	10,779

FIRES OF THE MONTH.

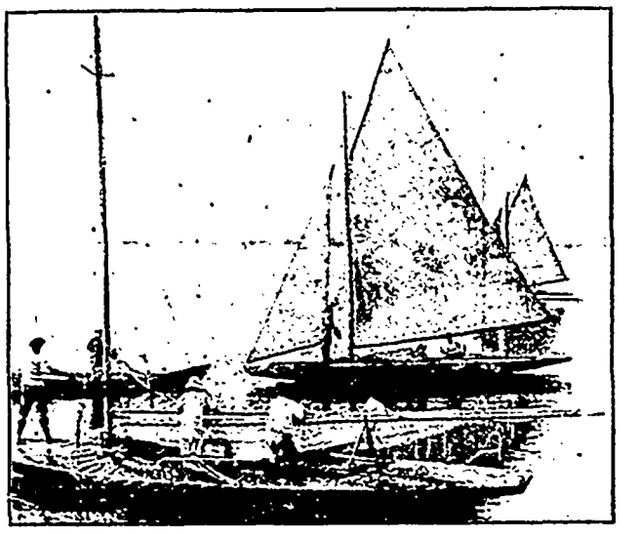
July 29th.—Sash and door factory of H. & F. Swim, Doaktown, N.B. Total loss.——Aug. 4th.—F. Moseley's tannery, St. Hyacinthe, Que. Loss, about $100,000.——Aug. 5th.—The C P.R. round house, at Revelstoke. The company lost a consolidated engine, a rotary snow plough and engine No. 59.——Aug. 15th.—J. T. Harvie's saw and lath mills. Loss, $10,000.— Aug. 19th.—The Hamilton and Toronto Sewer Pipe Co.'s Works, in Hamilton, Ont. Loss, $15,000.——Aug. 19th.—The Laurie Engine Works, Montreal: roof destroyed and pattern shop damaged.——Aug. 28th.—An explosion in the dust box in the Cobban Mfg. Company's Works, Toronto, caused $600 damage. Fully insured.——Steamer "Acacia" and steam launch "Athena" burned at wharf, Hamilton, Ont. Loss on "Acacia" $6,000; on "Athena," $4,000.

CAPTAIN MICHAEL T. FREE, of the Rochester, N.Y., fire department, and son-in-law of Wm. Johnson, Peterboro', Ont., has invented a swivel joint hose nozzle which has received very favorable notice.

THE Wallaceburg, Ont., Glass Company has resumed operations, with a full force of blowers. The company has orders ahead. It is estimated that $100,000 will be paid in wages during the present season.

THE SEAWANHAKA CHALLENGE CUP.

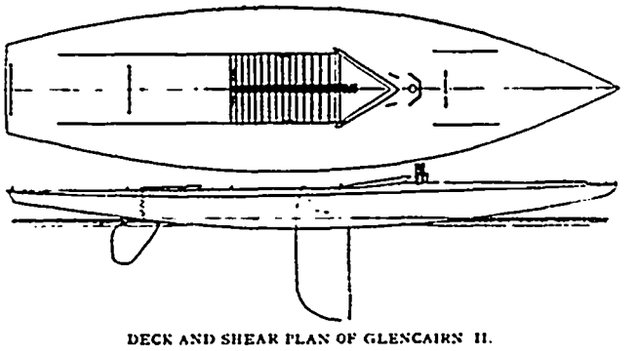
For the second time in succession the Canadian yacht designed by G. H. Duggan, C.E., of the Dominion Bridge Works, has won the Seawanhaka International Challenge Cup. Last year Mr. Duggan



GLENCAIRN II.

gained his victory on salt water at Oyster Bay, this year it was on Lake St Louis. The race this year was between Mr. Duggan's new yacht "Glencairn II" and the Seawanhaka Corinthian Yacht Club's representative "Momo," three times over a triangular course; total distance 12 miles: the winner to gain three out of five races. The following were the official measurements of the two boats

	Glencairn II.	Momo.
Length over all.....	32.15 ft.	29.50 ft.
Overhang forward	8 3 ft.	6.02 ft.
" aft.....	6.40 ft.	5.31 ft.
L.W.L.	17.43 ft.	18.17 ft.
Sail area	489.10 sq. ft.	456 32 sq. ft.
√ Sail area	22.12 ft.	21.35 ft.
Racing length	19.77 ft.	19.76 ft.



DECK AND SHEAR PLAN OF GLENCAIRN II.

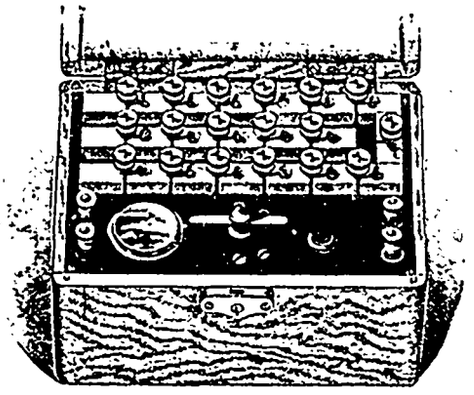
The first race was sailed on the 14th August, in a slight breeze, and was won by "Momo," the "Glencairn" having had a hole stove in her bow at the start. On Monday, 16th, the "Glencairn" won easily in a spanking breeze, and on the two following days repeated her victory, thus securing to Canada the trophy for another

G. H. DUGGAN, C.E., WINNER OF THE SEAWANHAKA CUP.

year The race was well and fairly sailed, and the stiff gales of the last three days were such as to make the contest a trial of real seamanship. In the final race Mr. Duggan's handling of his yacht, disabled as she was with a torn sail, was admirable.

RESISTANCE MEASUREMENTS.

In electrical measuring instruments few are more important than the Wheatstone bridge, and this has come to be realized to such an extent that to explain the advantages of this method of measuring resistances, or testing for broken circuits, short circuits and grounds, would be a waste of time and space The main requirements of such apparatus are, first, that it should be portable, convenient and easy to operate, and durable; second, that it should be accurate under all general conditions; third, it must have a wide range; fourth, it must be low in price.



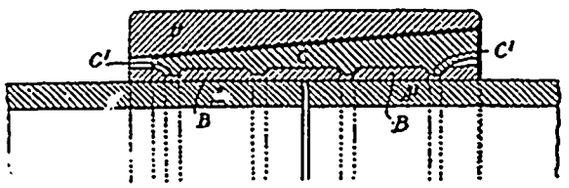
About a year ago, the Whitney Electrical Instrument Company, believing that apparatus combining all of these conditions was not easily obtained, commenced a line of experiments, and in presenting the Whitney Portable Testing Sets, they offer the result of several months study, and an instrument that they claim has been thoroughly tried and every weak feature eliminated. In size it is 8 x 5 x 5½ inches, and it weighs five pounds. They guarantee it accurate to within one-fifth of one per cent., and with its resistances as low as one-tenth of an ohm can be measured. The rheostat arms are formed by the two outside bars, and have a range of from one ohm up. The central bar comprises the two bridge arms, and by plugging or unplugging the ratio coils in these arms, the value of the rheostat coils are divided or multiplied as desired. The galvanometer is designed with especial reference to being extremely sensitive and quick to respond with a small current, and in the measurement of low resistances one cell will be found ample.

These testing sets are made in two styles. With batteries for outside testing and where access to batteries is not convenient, and without batteries for school and laboratory work. The type containing batteries is furnished with six cells so arranged that from one cell up to the full battery can be used. The instrument is also provided with two binding posts, so that battery from an external source can be used if desired. The battery is of the chloride of silver type. The cells will, it is said, last several months in constant service, and may be renewed at a very small expense. The instrument is mounted in handsomely polished mahogany, and all metal parts are substantially finished in lacquer.

The resistance is of special alloy, carefully made and highly insulated. There is, the makers claim, no appreciable temperature error under general conditions. At the present time, these sets are being made in a variety of ranges up to five megohms, and it is the intention of the manufacturers to build them with still greater capacity very soon.

RING JOINT FOR PIPES.

In the August number of THE CANADIAN ENGINEER we referred to a new system of jointing pipes which was being tested at the works of the Kingston Locomotive and Engine Co. The following description will assist our readers in forming an estimate of the value of this process.



This joint is applicable to steel, iron and other pipes, particularly water and gas mains of large diameter.

It consists of two or more parts, namely:—1. A packing strip; 2, a circumferential tapering wedge, and 3, a sleeve or compression ring. The joint will be best understood by reference to the accompanying figure which shows in sections, taken parallel with the axis of the pipes, the sections being taken through one side only of the pipes. In

all the drawings *A* and *A1* are the pipes, *B* the packing strip, *C* the taper wedge, and *D* the compression ring.

The packing strip *B* formed of any suitable compressible material, such for example as lead or india rubber, is laid circumferentially round the joint of the pipes. It may be of any width considered desirable, and of rectangular, curvilinear, corrugated or other section, and its edges or ends may overlap or may butt together, either parallel with, or diagonal to the axis of the pipes. It may be in one or more pieces, and though generally a loose piece, it may, if preferred, be fastened either to the taper wedge, which is placed over it, or to one of the pipe ends. Or it may be run into place after the pipes are put together. The taper wedge *C* consists of a band or ring, preferably of steel or other metal, formed in one piece, in which case it is split, or of two or more segments, which may have the ends or edges butting or overlapping, parallel with or diagonal to the axis of the pipes. Packing may be used at the divisions to make them tight if necessary. The wedge may be of any desired length or thickness, and may be plain. Internally it is usually of equal diameter at both ends, but it may be formed with a taper. Externally it is conical or tapering, thus forming a circumferentially tapering compressible wedge or ring, which contracts in diameter under the pressure of the compression ring or sleeve *D* which is forced over it in making the joint. The compression ring *D* consists of a rigid hoop or sleeve, preferably of steel or other metal, of any suitable length or thickness, having its inner surface tapered to correspond with the external taper of the wedge *C*. The inner surface of *D* may be grooved or recessed to reduce the area of its bearing surfaces on the outside of *C*.

The joint is made by forcing the compression ring *D* over the split wedge *C*, thus contracting it, and compressing the packing strip *B* around the ends of the pipes *AA1*. Conversely the joint may be loosened or taken apart by withdrawing the compression ring *D*.

Any suitable means may be employed for forcing the compression ring upon the wedge, such for example, as hammering it on, or using screw, hydraulic, or other power. Clamps or bands may be used placed temporarily round the pipes, and drawn together by screw bolts; two or more hydraulic presses suitably mounted in a suspension cradle may be employed for closing the joint. After the joint has been made the packing strip may, if desired, be caulked into an annular space between the pipes and the ends of the taper wedge.

Referring to the accompanying drawing we see a joint in which the ends of the pipes are butted one against the other. The wedge, *C*, is provided with four projections, *C1*, internally, so as to put pressure on the packing strip, *B*, at those points. This joint is the invention of D. J. Russell Duncan, C.E., who has fully protected it by patents.

Mr. Duncan has also during his visit to Canada had set up at the Kingston Locomotive and Engine Co.'s works a rolling-down machine for producing Williams' patent wedge-joint pipes. By this process steel pipes are made from flat steel sheets, rolled cold by machinery, without the aid of furnaces or heating agencies, and at a cost for labor, it is claimed, less than the cost of producing pipes by other processes. The manufacturer of steel pipes on Williams' patent longitudinal wedge-joint system is dependent upon very simple machinery. Plates, as they are received from the plate mills, are cut to the desired width in a shearing or slitting machine. This machine shears plates perfectly parallel, at the rate of 15 feet per minute. After passing through this machine, they enter the nibbing machine, in which the edges of the plates are bent inwards for about a quarter of an inch. From the nibbing machine the plates pass on to the skelp machine, in which they are bent into semi-cylindrical form. Two plates are employed in the manufacture of each pipe. These plates are bound together by means of two bars of steel, rolled to a channel section. These bars are placed internally in the pipe and the edges of the nibbed plates fit into the recesses in the channel bars. The pipe is then firmly bound by two concavo-convex bars, which run the entire length of the pipe and fit into the channel between the nibbed edges of the plates. The pipe when fitted together ready for rolling down is shipped on a cast-iron mandrel on the rolling-down machine, which exerts great pressure upon the two wedges, and flattens them in such a manner that they are securely locked in the channel bars, and bind the edges of the nibbed plate so effectively that the pipes, when tested, are found to be absolutely water-tight. The wedge bars, rolled down in this manner, may be said to resemble a continuous longitudinal rivet.

THE Vessot Grain Grinder attracted much attention at the Montreal Exposition, and will be entered at the Ottawa and Toronto Exhibitions. The machine is one of the best in the market, having been awarded a gold medal and diploma at the World's Fair, Chicago, 1893. S. Vessot & Co., Joliette, Que., are the manufacturers.

COMPRESSED AIR.

At pages 343-346, vol. 2, and page 317, vol. 1, of THE CANADIAN ENGINEER, descriptions are given of the Taylor Hydraulic Air Compressor, now at work at Magog, Que., in operating six engines, showing the printing machinery of the Dominion Cotton Mills Company, using 155 h.p., giving a pressure of 52 lbs. to the square inch. Though very little has yet been done to call attention to the merits of C. H. Taylor's invention, yet its simplicity and the efficiency obtainable from a given fall of water are so great that manufacturers, miners, capitalists, scientists, and every one who may by accident have heard of it, are writing for any available information from all parts of America, Great Britain, and many European countries.

In the meantime, the company has been securing and perfecting its patents in all important countries, and already has sold the rights for British Columbia, Washington, Montana and Idaho, for a large sum, and a company has been formed with head office at Spokane, Wash., to instal the system in those parts. This company is becoming active, and arrangements are about completed to instal a plant at Ainsworth, B.C., to develop 500 horse-power for use in the mines within a radius of five miles.

The plant at Magog has now been tested in all seasons and the system has proved itself faultless, giving the company using it great satisfaction, both in its working and in its economy. No one can see where there is any probability of the plant wearing out or repairs being required during an ordinary life time, unless it be to increase the size of the plant to give more power.

All will accord to steam, electrical and water power their full value, allowing to each a field where they are supreme All these are now well developed and their usefulness generally understood, yet compressed air, with its possibilities, is as yet a sealed book even to most scientists, though all are accustomed to the usual expression, "Compressed air is the coming power." It has come, and the world is indebted to Mr. Taylor for his ingenious invention, which transforms a water-power into compressed air at a minimum cost and maximum efficiency. Some of the advantages claimed for the system are as follows:—

1. It transforms a water power of any head into compressed air of any desired pressure without the usual intermediate losses.

2. Low heads of water, which would otherwise be useless for the production of power, can be used to advantage by this compressor.

3. The air is compressed at a constant temperature, viz.: that of the water, and is consequently delivered at a temperature generally below that at which it is taken into the compressor. Hence there is no loss of power by contraction in volume.

4. The air during compression is freed by the water of the greater part of its moisture, it being delivered so dry that it is impossible for condensation to take place during either its transmission or subsequent expansion.

Condensation and freezing of moisture in mains, etc., one of the chief obstacles to the use of compressed air, is entirely overcome by this method of hydraulic compression.

5. This compressor will maintain a constant pressure, even under a fluctuating head, without change of efficiency.

6. The compressor is entirely automatic in its action.

7. Owing to the absence of moving machinery the duration of a plant is almost without limit.

8. The absence of moving machinery dispenses with skilled labor, as practically no attendance is required.

9. When the compressed air is not used at the same rate as it is generated, it accumulates and may afterwards give, for a limited time as much as double the average power developed by the compressor, without change of pressure. This storage of power is effected by displacement of water, and not by an increase of pressure.

10. A plant does not require to be covered by a building.

With the question solved as to the compressing of air economically, as it is by the Taylor system, it is only reasonable to expect that progress in rapid strides will now be made by engineers and others to perfect the motor or other apparatus which uses the air, as hitherto all attention was given to the compressor and none to the motor, whilst in the use of steam all attention was given to the perfecting of the engine and not the boiler. The general public can find but little information on compressed air; the most accessible being such as is found in catalogues, in words such as "if you don't buy our compressor you can't use compressed air," in effect condemning unintentionally compressed air. Thus, also, has advancement in its use been retarded.

Again, how little knowledge is abroad regarding the transmission of air power; or, going further, how few engineers or scientists know anything of importance regarding its transmittable qualities? As it can only be transmitted through pipes, there is of course some decrease of pressure from friction, and hence some loss of power at the delivery

end, but far from as much as most imagine. Catalogues have done injury here to the cause of compressed air, though unwittingly, by printing tables showing the loss of pressure due to the friction of air in pipes, the intention being to show the size of the most suitable pipe for given cases of transmission And while telling about loss of pressure, they fail to tell that that loss does not necessarily mean to the same extent a loss of power Take a distance of, say, 10 miles, and the fact is said to be that there is but very slight loss of power if the pipes be of proper size If gauge pressure be, say, 80 lbs, or 95 absolute, on entering the pipe, and 70 lbs, or 85 absolute, at the other end, there would be a loss of a little above 10 per cent. in absolute pressure, but there would be an increase of volume of 11 per cent. to make up for the loss of pressure; thus the loss of available power would be less than 3 per cent. With higher pressure, still more favorable results could be shown. Such a power produced as economically as by the Taylor system, must surely be a "coming power."

Mining Matters.

QUICKSILVER is said to have been discovered just outside of Dartmouth, N.S., recently.

THE Elginfield Oil and Gas Co. struck a fine gas well near Wallacetown, Ont., recently

THE Dardanelles Mine, Nelson, B.C., will soon have a steam plant air compressor in place, it is said.

THE smelting works in Hamilton, Ont., are receiving ore from the Coe Hill iron mine in Hastings county, Ont.

THE Ruth mines, Sandon, B.C., will put in a concentrator, and the Slocan Star Company has surveyed a site at Cody for one to treat the ore from their Noonday property.

THE long-standing trouble between the town of Kingsville, Ont. and the Natural Gas Company that has been supplying the town, has been settled by the town buying out the plant of the company for $27,000.

GOLD has been discovered on the farm of James McLean, about two and one-half miles above McDonald's Corners, Lanark County, Ont. Experts are at work to ascertain whether it can be worked to advantage.

THE Pictou Charcoal Iron Company has given a lease with option to purchase their blast furnace and plant at Bridgeville, N.S., to the Mineral Products Company, which intends operating the deposit of bog manganese near Hillsboro.

THE Canadian Gold Fields Co. has ordered from the Ingersoll-Sergeant Drill Co. a seven-drill compressor, 80-horse power steel machine drills, Ledgerwood hoisting engine and all necessary adjuncts, to be delivered by the Drill Company, ready for operation, in 45 days from August 7th.

A CONTRACT has been let for the machinery for a 100-ton concentrator and a double tramway 8,500 feet long for the Montezuma Mining Company, Kaslo Creek, B C The cost of the tramway and concentrator complete will be about $45,000. The mill will be erected under the supervision of T L Mitchell.

A VERY important discovery of gold-bearing rock is reported on what is known as the Diamond property, in the tenth concession of Madoc, Ont. D. E. K. Stewart has found a vein, four feet wide, of mispickel, with quartz showing free gold The mispickel assayed several hundred dollars per ton. The vein has been stripped for several hundred feet, and a shaft has been sunk to a depth of 10 feet.

A MEETING of the British Columbia Association of Mining Engineers was held in New Denver, B C, recently. Among others present were H West, A.R S M., A J. Colquhoun, M E. F. Monckton, F.G.S, A Dick, Captain Morrish and M A. Bucke. It was decided to affiliate with the Canadian Mining Federation, also to make arrangements for a grand rally and banquet in Vancouver next January. The association aims to be representative of the mining engineers and mine owners of British Columbia, and has upwards of 80 members, all of whom are men of standing in the profession.

SOME changes in the British Columbia mining regulations are looked for at the next session of the legislature, as the outcome of Prof. Carlyle's recent tour of the mines. The present Act is most liberal, in that it admits of the recording of locations before performing any development work whatever; there is a disposition on the part of claim owners to shirk the annual assessment falling due within the year following the location of claims by a system of re-locating. The effect of this is that large areas are staked off and no work is performed beyond the driving of the stakes. In one district one man was holding sixty claims The regulations will, therefore, be made more stringent.

THE Trail, B.C., smelter produced the first gold brick, Aug. 11th.

VERY rich discoveries of gold are reported from Indian Head, near Sherbrooke, N.S.

THE Dominion Coal Company shipped about 150,000 tons of coal up the St. Lawrence in July.

A SAW MILL and stamp mill will, it is said, be built at once at Bell City, Seine River district, Ont.

N. H STEVENS, Dr. Holmes and others have organized a company to supply Chatham, Ont., with natural gas from Kingsville.

A W. CARSCALLEN has ordered from the Wm. Hamilton Mfg. Co., Peterboro, Ont, for the Belmont gold mine, a ten-stamp mill.

AT Deloro, Ont., the Canadian Gold Fields Company has increased its force to two hundred men, and they are working day and night.

DR. W. L. GOODWIN and F. J. Cope have recently held prospectors' classes in connection with the School of Mining and Agriculture in Madoc and Bancroft, Ont.

P. HEIMINCK & Co. propose to establish a smelter at Edmonton N.W.T., on condition of receiving a bonus of $10,000 and certain exemptions.

GOLD is reported to be found in paying quantities in Ottawa county, on the farm of Louis Dozios, on the north shore of the Ottawa River, about twelve miles above Aylmer, Que.

THE North-Western Mining and Development Company is said to have struck a silver mine in the township of Barrie, Frontenac county, Ont. After going down twenty-five feet the vein was seven feet wide. The ore assays from $56 to $300 per ton.

JAMES KING, Quebec; W. Yuile, Montreal; J. de Labroquerie Tache, St. Hyacinthe; J. R. Tache, Quebec, and L. Gendreau, St. George's, are to be incorporated as the Central Quebec Gold Fields Company; capital stock, $6,000, head office, Quebec.

A COMMITTEE, consisting of Oliver Durant, J. B. McArthur, and J. F. McCrae, appointed by a mass meeting of the citizens of Rossland B.C., has prepared a memorial to lay before the Dominion Government, protesting against the imposition of an export duty on British Columbia ores.

THE British Admiralty has ordered sixty tons of coal from the newly-discovered veins on the west coast of Newfoundland, to be used by the warship "Buzzard" as a test. If the quality of coal is satisfactory St. John's will, it is said, be created a dockyard and naval station.

FEODOR BOAS, managing director of the Danville Asbestos Company, and J. N. Greenshields, Q.C., of Montreal, are at present opening up a new mine about three miles from Danville, Que., on the Richmond road. Some years ago a vein of galena was discovered and the samples submitted to an analyst showed 63 per cent. copper and $13 silver per ton.

PROF. A. P. COLEMAN, Ontario Government geologist, recently returned from a tour through the mineral regions of Western Ontario, and reports some interesting facts. The area in the Wahnapitae region in which gold mines of importance have been found, is comparatively small. "I think," he says, "it will be much more extensive as soon as prospecting goes on. At present some of the townships are closed to prospectors pending an enquiry into the character and extent of the timber resources which exist there. Several new finds have been made at Mosher Bay, one of the upper arms of Lake Manitou One of a very promising character belonged to Gasse & Leullier, two Frenchmen. There was a very large body of quartz which would average seven feet in width, and the owners had followed it along the face of a hill for half a mile, and had opened it for perhaps 25 or 35 feet. I saw a number of specimens while there that were quite rich. In the Saw Bill Region a number of finds of very rich quartz, containing free gold, were made before I left there," Dr. Coleman explained. Those were to the north of Lynx Head Falls, and prospectors were to be encountered everywhere. It is probable that a considerable amount of gold will be found in that district, judging from appearances.

TEXADA ISLAND is a veritable wonderland. By the steamer "Maude" the owners of the Nutcracker claim on Texada Island received a number of specimens from their claim which in richness and apparent permanency eclipse anything yet received from the far-famed Texada. The specimens were taken from the bottom of the shaft being sunk by McCloskie & McDonald. The depth is about 22 feet, and the ledge opened out four feet wide. The gold is of a very bright color, resembling Australian gold. The specimens also give evidence of being rich in silver. Experts pronounce it the most valuable of the many developments of Texada Island, insomuch as the gold is in solid rock and not in the surface crevices, the same as the Lorindale and other claims. They have only struck the foot wall, and, although the ledge has been opened four feet, it has not yet reached the harging wall. The owners are Mrs. Edwin Gough and Robert Evans of the Nanaimo

Hotel, and J. W. Stirtan, superintendent of the Nanaimo waterworks. The Van Anda "Copper Queen" shaft is taking out some fine rich variegated copper ore, which should from all appearances run high in value. The Raven mine has now got a well-defined vein of payable ore and will soon be making regular shipments. Operations at the Kirk Lake gold mines are in full swing. The new hoist plant and pump are expected to arrive within the next few days. The directors are negotiating now for a twenty-stamp mill which is expected to be in operation not later than October 1st. The Kirk Lake Company have over 1,200 tons of ore on the dump ready for milling which from tests made from shipments to San Francisco and Tacoma shows an average value from $22 50 to $64 per ton The Surprise mine is erecting hoist plant, and will sink to the 250 foot level. The Silver Tip mine shipped 100 sacks of ore on the steamer "Comox" and the Victoria-Texada mine shipped 100 sacks of ore on the steamer "Maude" to Victoria. A notable fact is that so far all veins have improved most remarkably at 100 feet depth, and the general outlook is that the island will ere long be a busy hive of workmen, as soon as a little more development work is done.—*Nanaimo Free Press.*

JAS. BREEN, manager of the Le Roi smelter, recently gave the following reasons for the selection of Northport as the site for the new plant. "One of the principal reasons is that in the operation of a smelter of 300 tons capacity it will require approximately 40 tons of limestone daily to flux the excess of silica contained in the Le Roi ore. This limestone now costs the B. C. S & R. Company, whose smelter is located on the Columbia River at Trail, $3.50 per ton. The Le Roi Company at Northport can deliver a superior quality of limestone to any found in Kootenay in their works for 25 cents a ton, saving approximately $50,000 a year in this item alone We can lay down coke in Northport for $2.50 per ton less than in Trail, and in our smelting operations we will use about 45 tons of coke per day, making a saving in this item of $45,000 per year. We will also save $1.50 per ton on coal, of which we will use about 20 tons per day, making a saving of $10,000 a year. The cost of our plant will be reduced 5 per cent. by reason of cheaper building material and freight rates, without considering the innumerable articles entering into the construction of a smelter which have to pay duty, notwithstanding that the machinery comes into Canada duty free. On renewals and repairs there will be a monthly expense of $2,500, on which there will be a saving of $2.50 per ton in freight and 30 per cent. in duties as against any point on this side of the line. The saving in this item alone will approximate $15,000 a year. We will save at least $1.50 per ton on outgoing freight On a basis of 20 tons per day this will amount to $15,000 per year. Taking these items and others which I have not mentioned, for instance the saving of $1 per cord on wood, this represents roughly a saving of $150,000 per year, or $1.50 per ton of ore smelted. It is patent to everyone that this is just so much saved to the producers of ore in the Rossland district, and were an export duty placed on ore this saving would not be effected. It should also be borne in mind that besides establishing competition in smelting, the erection of the Northport plant secures a freight rate on ore of 75 cents per ton, instead of $2, as heretofore charged."

IN an interview with a representative of the Toronto *World*, J. A. Caldwell, proprietor of the famous Sultana mine, gives the following details about the mine. The main shaft is now down 360 feet, with 1,000 feet of drifting distributed over five levels. The vein being lenticular in form, has narrowed and at times almost pinched out; but the lead is never lost Up to the present time the mine has been operated by a plant consisting of a few light drills and a ten-stamp mill, which latter, by the way, has come in for a lot of criticism by certain experts, for the stated reason that it did not save as much of the gold as it should, a considerable percentage passing off in the tailings; but Mr. Caldwell said that he is getting from 75 to 80 per cent. of the gold in his ore in the batteries and on the plates, and 10 per cent. more in the concentrates, or from 85 to 90 per cent. altogether, which is an extremely high and satisfactory average. Machinery of high capacity is now being installed, the capacity of the mill is to be increased five times At present 30 head of stamps are being put in place, but room and power are being supplied for 50 stamps. The new boilers, shafting, etc., are equal to the calls of a 50-head mill. The mill is to be very complete, with the latest and most approved Gates crusher, batteries, vanners, etc., and will have a daily capacity of 80 tons of ore. A new chlorination plant will handle the concentrates. In the new mill, which is being put up on the side hill beside the old one, gravitation will be taken advantage of in conveying ore from the shaft. In order to keep this big mill going skips and a 75-horse power hoisting engine are being installed, together with pump and a compound duplex air compressor, capable of furnishing power to 20 or 12 drills. Only eight, however, will be run this fall. There is a large quantity of ore in the five levels ready for stoping, so that, with the extra drills, there will be no difficulty in getting out the necessary 80 tons per day. From the new shaft house, now in course of erection, the rock will be run on a level tramway to the crusher. The mine has a water power system and an electric light plant of its own. Most of this machinery is made in Canada, being furnished by the Jenckes Machine Company of Sherbrooke, Que., and the Canadian Rand Drill Company.

Electric Flashes.

ACTON, Ont., will probably have electric light in the near future.

AN electric light plant will be placed in the Jackson & Cochrane foundry, Galt, Ont.

THE Lanark county electric railway bonus by-law, which was voted on recently, in Perth, Ont., was defeated by a majority of over fifty.

THE Connecticut Telephone and Electric Company, of Chicago, U.S., have been making enquiries in reference to a telephone franchise in Toronto recently.

I. J. GOULD, owner of the present electric light service in Uxbridge, Ont, will probably extend his plant by the addition of incandescent lighting to that now in service.

CARLETON PLACE, Ont., is in favor of the Lanark County Electric Railway. A public meeting to discuss the scheme was held recently, and it was unanimous in support of it.

[illegible] McLEAY, M.D., of Watford, Ont., has purchased from the Re[illegible] Electric Company a 500 light alternator and the necessary transformers, and is installing an incandescent plant in the town of Watford.

G. A. CLARE, of Clare Bros. & Co, stove and furnace manufacturers of Preston, Ont., says that much of the business activity of that town is due to the freight facilities provided by the Galt, Hespeler and Preston Electric Railway.

A PECULIAR accident resulted in the burning out of the motor used to open and close the swing bridge at the beach, Hamilton, Ont., not long ago. The watch chain of the man in charge dropped in such a way as to short circuit the motor with the result mentioned.

THE Exeter, Ont., Electric Light and Power Company, recently organized to take over the lighting business in Exeter, formerly operated on a small scale by Captain Howard, has placed an order with the Canadian General Electric Company for a 1,000-light, single phase alternator, of the standard iron-clad armature compound-wound type.

LA Compagnie Electrique, of Chicoutimi, Que., has increased the lighting capacity of its plant by the addition of another 40 K. W. "S. K. C." Generator, which it has purchased from the Royal Electric Co. This addition has been made necessary owing to the growth of their power transmission work.

PAMPHINE BOIVIN, of the town of Baie St. Paul, Que., has received a franchise from the corporation of that town for electric lighting, and the Royal Electric Company is now installing for him an electric lighting plant consisting of a 500 light "S.K.C." dynamo, with the necessary transformers and material.

THE Kootenay Electric Company, of Kaslo, B.C., who have a large water power near the town, and purpose using the same for power and lighting, have placed their order with the Royal Electric Co. for a 75 K. W. "S.K.C." generator, and the necessary transformers and motors. The water will be carried in by a 42-inch stave pipe flume about 1,300 feet long, which will run to the power house.

SOME years ago the Dominion Government claimed duty on all the rails brought into Canada for street traffic purposes, and compelled payment of the same after they had got a decision in their favor in the Canadian Supreme Court. The Toronto Railway Company carried the case to the Privy Council, and got a judgment in their favor, and the money paid in by them was refunded by the Government. Recently the Toronto Railway Company made a motion before the Privy Council to have the interest allowed on the duties paid by the company, and judgment was given in favor of the motion, so that the Government will be compelled to pay a further sum of $10,000 or $11,000 to the railway company.

THE new Electric Locomotive recently shipped from the works of the Canadian General Electric Co. to the Hull Electric Co., is the largest machine of the kind so far constructed in Canada. The motive power will be furnished by a four-motor equipment of G. E. 51 motors, having at normal current input a capacity of 80 horse-power each. The trucks are of the McGuire "L" pattern, with steel rim wheels. The body, which differs in operation and detail from the first locomotive supplied to the Hull Electric Company, was built for the Canadian General Electric Company by the Crossen Car Company of Cobourg, Ont.

THE Bell Telephone Co. is putting in an up-to-date switchboard in the Ingersoll office.

THE new power-house for the Sherbrooke Street Railway Co. is being built by Loomis & Sons, Sherbrooke, Que

THE Fenelon Falls Lumber Company has purchased a 250 light incandescent plant from the Canadian General Electric Company.

THE Yarmouth, N S , Street Railway Company has purchased a 45 kilowatt generator from the Canadian General Electric Company.

THE Canadian General Electric Company is installing a 150-light incandescent plant for the estate of Ross Bros., Buckingham, Que.

I MATHESON & Co., Limited, New Glasgow, N.S., have purchased an incandescent lighting generator from the Canadian General Electric Company.

THE Montreal Street Railway Company has placed an order for fifty additional G. E. 1,000 motors with the Canadian General Electric Company.

THE Canadian General Electric Company is installing an incandescent lighting machine for the Toronto Paper Company at the Cornwall, Ont., mills.

THE Canadian General Electric Company is constructing a 75 kilowatt steel frame, direct connected, direct current generator, for McGill University, Montreal.

THE British Columbia Mills Trading Co., Vancouver, B.C., is lighting its mills by electricity, the plant being furnished by the Royal Electric Co , Montreal.

DORAIS & DOBBIN is the style of a new firm of electrical contractors, 4 Beaver Hall Hill, Montreal, which makes a specialty of equipping electric lights and bells.

THE Canadian Pacific Railway Co. has recently largely increased the staff in its car shops at Perth, Ont., and is working overtime. The Royal Electric Co. is installing a plant in the shops.

CHAMPOUX & BROS , Disraeli, Que., are installing a 650 light alternating current dynamo, which they purchased from the Royal Electric Co. They are lighting the town and their mills

THE Doherty Organ Company, Clinton, Ont., requiring an increased dynamo capacity, has placed an order with the Canadian General Electric Company for a 200 light incandescent machine of the Edison type.

R. SMITH & Co., Sherbrooke, Que., have recently installed a 100-light plant in the Montague Paper Company's new steam saw-mill, at Lake Megantic, Que., and are also building a 200 light electric plant, alternating current, for Dr. Edgar, North Hatley, Que.

THE Canadian General Electric Company has received an order for a 2,000-light, single phase alternator for Revelstoke, B.C. This machine, which will be of the standard iron-clad revolving armature type, compounded to secure automatic regulation, will be used to supply incandescent lighting in Revelstoke and vicinity.

THE CANADIAN ENGINEER had the honor to receive an invitation to attend the 19th annual Rhode Island clam dinner tendered to the electrical fraternity by Eugene F Phillips, president of the American Electrical Works, Providence, R I., at the Pomham Club, August 21st. It is unnecessary to say we regretted our inability to attend.

THE Canadian General Electric Company is installing a 75 kilowatt monocyclic generator for Kilmer, Cowan & Co., of Southampton, Ont. This machine, which will be operated from a water power, conveniently located, will supply current for incandescent lighting and power for the two neighboring towns of Southampton and Port Elgin, Ontario.

ON August 20th the Kingston Street Railway was handed over from 2 to 10 o'clock p.m. to the nurses of the Kingston General Hospital, who acted as conductors and collected the fares in aid of the Hospital. Quite a handsome sum was realized, and kindly comments were made on the philanthropy of B. W. Folger, the proprietor of the road, which took this form.

THIS is a time of peace, says a Maritime Province exchange, but the defences of Halifax harbor are to be strengthened. A powerful electric searchlight will be placed in the fort at York redoubt, at the entrance to the harbor, and a new battery for quick-firing guns built at Point Pleasant, making four batteries within gunshot of each other, though hidden in the woods of the public park.

THE corporation of Magog, Que., has awarded the Canadian General Electric Company the contract for a 1,000-light single phase alternator and other apparatus for their new incandescent lighting plant. The street lighting will be done by 64-50 c.p. incandescent lamps, which are expected to furnish a much more satisfactory street lighting service than their equivalent of arc lamps.

THE patent rights for Canada of a new storage battery which is now in use, after ten years test, by the Electrical Power Storage Co., London, are advertised for sale in this issue of THE CANADIAN ENGINEER.

THE Aylmer Electric Light and Mfg Company, Aylmer, Ont., is installing an extensive incandescent lighting system. It has awarded the contract for the apparatus required for the plant to the Canadian General Electric Company. The generator will consist of a 60 kilowatt, 1,000-light standard single phase alternator of the revolving iron-clad armature type, compounded to secure automatic regulation.

Personal.

PIERRE POITRAS, contractor, Chicoutimi, Que., died not long ago.

JOHN R. ALLAN, O.L.S., is to be the engineer for O'Neil & Ferguson on their contract in the Crow's Nest Pass Railway.

ROBERT BARROW, son of City Engineer Barrow, Hamilton, Ont., has gone to the Klondike with a Government exploration party.

J. G. SIBBALD, who has represented the Carnegie firm, of Pittsburg, for some time in Montreal, died recently in New London, Conn.

R. E. L. BROWN, W. H. Young and J. R. Stephens have opened an office in Victoria, B.C., and are doing business as mining engineers.

WHILE bathing in the St. Lawrence, at the Montreal plumbers' picnic, held August 14th, A. Lebel, machinist, was accidentally drowned.

H. SMITH, engineer at Wortman & Ward's foundry, London, Ont., was recently seriously burned while throwing refuse paint into the furnace.

THE death was announced by cable recently of Mrs. A. Galt, mother of John Galt, C.E., of Toronto, which took place at Kilmarnock, Scotland.

R. CARR HARRIS, C.E., formerly professor of engineering in the Royal Military College, Kingston, Ont., has started for the Klondike, taking his two sons with him.

PATRICK G. ALEXANDER represented the *Engineer*, London, England, at the meeting of the British Association for the Advancement of Science, in Toronto, last month.

CAPTAIN P. G. TWINING, R.E., instructor of engineering at the Royal Military College, Kingston, Ont., was married to Miss Louise Daly, of Napanee, Ont., last month.

AS a result of changes in the engineering department of the Grand Trunk, William Crawford, Hamilton, Ont., will be master of buildings and bridges, with headquarters at London.

JOSEPH NICHOLSON, foreman of the tin department, has been appointed superintendent of the tin, stamping, re-tinning, galvanizing, japanning, enamelling and machine shops at the McClary Manufacturing Co.'s works, London, Ont.

W. W. LA CHANCE, formerly of the firm of Gregg & La Chance, architects and engineers, Cleveland, Ohio, has returned to Hamilton, Ont., his native city, to resume his profession as architect, after spending ten years in the United States.

T. R. DEACON, C.E., has formed a partnership with J. E. Switzer, O.L.S., C.E., late assistant city engineer for Ottawa, Ont., and the new firm of Deacon & Switzer will carry on the business of engineering and surveying at Rat Portage, Ont.

C. F. HANINGTON, C.E., Shediac, N.B., has been appointed assistant engineer of the Crow's Nest Pass Railway. Mr. Hanington has had a large experience in railroad engineering, and was a member of the staff on the original survey of the C.P.R.

W. T. JENNINGS, C.E., late city engineer of Toronto, who was formerly with the C.P.R., has been engaged by the Dominion Government to go out immediately with a party and furnish a report on the best means of getting into the Klondike country by railway over an all-Canadian route. At the same time he will take a look at others, and in fact at all available routes, so as to supply information upon which the executive may rely.

FREDERICK PRESTON RUBIDGE, for thirty years architect of the Public Works Department, Ottawa, and one of the most eminent members of his profession in the Dominion, died at his residence recently, in Montreal, in the ninety-second year of his age. The deceased was superannuated in 1872, previous to which he was actively employed on the parliamentary and departmental buildings, and superintended the construction, midway up Parliament Hill, of the picturesque path known as the "Lovers' Walk." The first few years after retiring from the civil service Mr. Rubidge spent at Ottawa, removing then to Hamilton, and some fourteen years ago to Montreal.

GRANVILL C. CUNNINGHAM was presented with an address by 800 employees of the Montreal Street Railway Co. previous to his leaving for Birmingham, Eng.

A. C. STONEGRAVE has been appointed general agent of the freight and passenger departments of the Central Vermont Ry. in Canada, a promotion upon which he has received many congratulations. His offices will be in the Board of Trade Building, Montreal, P.Q.

ROBERT MITCHELL, president of the Robert Mitchell Co., Limited, brass founders, died at the age of 76 in his home, in Montreal, Sept. 1st. He was a native of Scotland, being born at Prestonpans. He was in business in Montreal from 1851, and has always been one of the most prominent business men of the city, though his modesty prevented his taking the part in public affairs that those who knew him felt he was qualified to fill.

PETER MCMICHAEL, for many years the popular assistant manager of the Toronto branch of the James Robertson Company, Limited, has been promoted to be manager of the St. John, N.B., branch of the firm. On the eve of his departure a few of the many business firms, who, by contact, had recognized his sterling qualities, presented him with a costly diamond ring and illuminated address. The following firms were represented at the presentation: Booth Copper Co., Limited, per G. H. Booth; Goderich Organ Co., Alex. Saunders; Miln-Bingham Printing Co., James Miln; Montreal Rolling Mills Co., John Irving; James Morrison Brass Mfg. Co., James Morrison; John Ritchie Plumbing Co., Limited, A. N. Richardson; Toronto Foundry Co., H. W. Anthes; Toronto Radiator Co., Adam Taylor; Toronto Hardware Co., J. H. Paterson; Toronto Steel Clad Bath Co., A. G. Booth; Toronto Standard Manufacturing Co., J. J. Torrance; Gurney Foundry Co., Limited, W. N. Garrick.

MAJOR HENRY FULLERTON PERLEY, M. Inst. C.E., who died at Bisley, Eng., July 17th, from bronchitis, was a resident of Ottawa. He was born in St. John, N.B., in 1831. He entered the public service of New Brunswick in the year 1848, continuing until the summer of 1852 on exploratory surveys for a proposed system of railways. In 1852 he was engaged by Pets, Betts & Brassey on surveys in the province of New Brunswick and Nova Scotia, and employed by them during 1854-55-56 on the construction of the Grand Trunk Railway between Montreal and Brockville. In August, 1856, he again entered the service of New Brunswick as resident engineer on the construction of the E. & N A. Railway between St. John and Shediac, remaining until the completion of the line in December, 1860. Between 1861 and 1863 he was engaged in private practice. In May, 1863, he entered the service of the Government of Nova Scotia, continuing as provincial engineer until August, 1865; then resigning to fill the position of agent for Keth, Waring Bros. and Lucas, contractors for the construction of the Metropolitan Extension (underground) Railway, London, England. At the completion of this engagement, in 1870, he returned to New Brunswick and took charge of the works in connection with the improvement of the freighting facilities of the Government Railway in that province, and the construction of the deep water terminus and extension line at St. John. In May, 1872, he was appointed engineer in charge of harbors, etc., in the Maritime provinces for the Department of Public Works, which position he held until the close of 1879, when he was appointed chief engineer. This position he held up to 1891.

Railway Matters.

IT is said that 27 bridges will be required on the Crow's Nest Pass Railway between Medicine Hat and Lethbridge.

THE Ottawa and New York Railway is not to be compelled to put a draw span into its St. Lawrence bridge at Cornwall, in spite of the objections of the shipping interest to any obstructions in the navigation.

WM. RUSSELL, C.E., is now engaged in locating the line of the Pembroke Southern Railway, which will connect Pembroke with the Ottawa, Arnprior and Parry Sound Railway. The distance to be built is twenty miles.

THE Quebec Central Railway Company is commencing to relay a considerable portion of the main line between Sherbrooke and Quebec with new seventy pound steel rails. The Carnegie Steel Company are supplying the rails.

THE employees of the Pacific Division of the C.P.R. recently presented H. Abbott, late general superintendent, with a massive silver punch bowl, and a pair of candlesticks and a purse of money. The presentation was suitably acknowledged by Mr. Abbott.

WE are requested to announce that the next annual convention of the Association of Railway Superintendents of Bridges and Buildings will be held at the Brown Palace Hotel, Denver, Colorado, on Tuesday, Oct. 19th. The secretary is S. F. Patterson, Moberly, Mo., from whom the programme can be obtained.

SOME of the contracts let for the construction of the New York and Ottawa Railway are: Grading, Peppard & Balch, Minneapolis, Minn.; rails, Johnston & Co., Johnstown, Pa.; masonry for bridges, Soovsmith & Co., New York; iron work on bridge, Phœnix Construction Company. The contract for the bridge requires that it shall be ready for construction trains on November 15, and for general traffic on January 1, 1898.

THE C. P. Ry have taken out a permit to build a $14,000 engine shed at the foot of Simcoe st., Toronto, and shops for light repair will be built. The making up of trains will be done along the water front, so that many engineers, firemen, baggagemen and others will be moved from Parkdale, where such work has been hitherto done.

THE Canada Atlantic are building a line, about six miles in length, from Lacolle, in the county of St. Johns, Que., to a place called Alburgh Springs, in the State of Vermont. This includes a bridge across the Richelieu, the latter being built by day work. The contractor for the road is Mr. Fauquier, who built a good portion of the Parry Sound extension of the Canada Atlantic. Mr. Mitchell, of Kingston, is the sub-contractor, and the new line will in all probability be completed by October next.

ABOUT 100 miles of the Crow's Nest Pass road is already under contract, and track-laying began at Lethbridge on the 29th July, and was commenced at McLeod, 40 miles westward, early in August. The second fifty miles have been divided into sections of from five to ten miles long, and awarded to Messrs. McArthur, Buchanan, Strevel Keith and Bowels, all of Winnipeg; McGillivery, of Vancouver, and Hugh Mann, of Rossland. It is more than probable that the first hundred miles will be completed before the end of the year and another section well under way.

GENERAL MANAGER CAMPBELL, of the Dominion Atlantic Railway of Nova Scotia, has made the following changes in the staff: The resignation of the resident manager, K. Sutherland, went into effect at the end of July, and P. Griffin is appointed to the position. Mr. Sutherland was in addition to superintendent the road's engineer. Edward M. Stewart, C.E., who came out from Scotland two months ago with Mr. Campbell, is appointed chief engineer.

THE Montfort Colonization Railway Company are pushing the extension of their line to Arundel, Que. The railway has already been built from St. Sauveur Junction, on the Canadian Pacific, to a distance of 21 miles, and now 12 miles additional are being built, bringing the road to Arundel, and making a total of 33 miles. Unfortunately, when the Montfort road was started, the directors decided to make the gauge three feet, which necessitates a great deal of difficulty in the transhipment of freight at St. Sauveur Junction. A movement is on foot to have the line changed to the standard gauge.

J. M. SHANLY, engineer of the Atlantic and Lake Superior Railway Co., reports that the work of ballasting the road from Metapedia to Caplin, 80 miles, is progressing and two trains a day are running. The contract for grading from Caplin to Paspebiac, 20 miles, has been awarded to Perrault & Gervais, who will finish their work this fall. There will be two bridges, one over the Big Bonaventure River, 300 feet long, and the other over the Little Bonaventure, 60 feet, both of which will be constructed of stone, with an iron superstructure. The proposed extension to Gaspe Basin will not be near as heavy work as was to be anticipated

Marine News.

THE Inland Navigation Company, capital $13,000, of Charlottetown, P.E.I., is applying for incorporation.

RODOLPH E. LEMIEUX, M.P., and Robert Lindsay, of Gaspe, have arranged with the Department of Commerce for placing a weekly service for freight and passengers on the St. Lawrence, between Quebec and Gaspe. There will be only one steamer to commence with.

AT the meeting of the shareholders of the Canada Shipping Company held in Montreal recently, the offer of Peterson, Tate & Co. to purchase all the steamships of the old Beaver line, to take over the office and the whole of the business of what is known as the Canada Shipping Company, was accepted.

THE Department of Public Works has just finished at Sorel a large dredge, called "The Laurier." It will be escorted by a new steel tug, to which Mr. Tarte has given the name of "St. Johns and Iberville," the division which he represents. The Minister is negotiating for a plot of land at Sorel on which to erect additional new workshops.

THE C.P.R. will add to its fleet on the Columbia an express boat for carrying passengers, mail and express. The keel of the new boat was recently laid at Nakusp. It is thought this boat will be the fastest in any of the inland waters of the North West. It is expected to make the time from Trail to Arrowhead in 24 hours, equal to 19 miles an hour. She will be christened "The Flyer."

To meet the opposition of the line from Alexandria Bay to Montreal, the R & O. Nav. Co have placed three extra steamers a week on that route, the extra boats reaching Montreal an hour before the regular boat The company contemplate building two new palace steamers to run between Toronto and Prescott, and to be built with turbine propellers of the type referred to in a late issue. Such boats would be capable of making 35 to 40 miles per hour, and would do the trip from Toronto to Kingston in from four to five hours if no stops were made at lake ports. No decision has yet been come to on this matter, but meanwhile the regular boats will be altered and improved, adapting them better for tourist travel.

Recent English papers contain accounts of the launching of two magnificent ships for the Elder-Dempster Company of Liverpool and Montreal. One was launched at Wallsend-on-Tyne, and christened the "Monarch." She and her sister ship the "Milwaukee" are the largest freight steamers yet built in England. Her dead weight cargo capacity is 11,500 tons, while her measurement cargo is over 18,000 tons, besides 700 tons of bunker capacity. Her length is 483 feet, beam 56 feet, depth 42 feet 3 inches to the shelter deck. She has 12 steam winches for handling cargo, is lighted by electricity, and the cattle stalls, etc., are of the latest type. The other boat, the 'Montrose,' was launched at Middlesborough. She has a dead-weight capacity of over 8,000 tons, is 400 feet long, 52 feet beam and 30.7 feet deep. She is fitted up with cold storage apparatus for dairy produce, etc

LITERARY NOTES.

The 41st annual report on the sewage and water supply of St. John, N B., has been compiled by Wm. Murdoch, C.E., engineer of the department. The daily average water supply for St. John is 4,903,100 gallons being 135.2 per head of population, or deducting that used by manufacturers, railway and shipping, etc., 124 gals. per head of east side population. During the year 79 new services were laid at an average cost of $24.04 each. The total pipeage of the city is 95.15 miles There are 174 water meters in use. During the year there were 4,400 feet of sewers built, at a cost of $13,852. One of these, which was a difficult work, will be referred to again in this journal.

We have heard so much of old London lately, that a sketch of our Canadian London will be specially interesting by way of contrast, and therefore the new history of London, Ont., compiled by Archie Bremner, and published by the London Printing and Lithographing Company, is both timely and valuable This work contains 136 pages 9 x 12 inches, and is illustrated by over 300 half tone engravings, including a map of Western Ontario The illustrations alone would almost portray the history of the city, but the writer has given a most graphic and entertaining narrative of the evolution of a modern Canadian city from its log cabin beginnings, in 1826, down to the Jubilee celebration of this very year, and embracing almost every phase of its civic life and all its institutions The book is free from advertisements, and is creditable alike to the author and the printers and publishers Sample pages and prospectus will be sent to any one interested.

We have to thank Chevalier Chs. Baillairge, librarian of the Geographical Society of Quebec, for a copy of the transactions of that society from 1893-97, which make a volume of 340 pages in all. This society is doing a most important work in showing the greatness and value of our unknown northern regions, and deserves the encouragement they are now seeking from the Government Among the contributors, besides M Baillairge, are Dr Robt Bell, A. P. Low, John Bignell, H O'Sullivan, and others well known in connection with exploratory work, and several engravings and maps accompany the papers The work throws a good deal of light on the regions about Hudson and James' Bays, and will be specially valuable now that those regions must soon be opened up by means of railways. We hope to refer to the work at greater length in another issue.

The annual report of the several departments of the city government of Halifax, N S., has reached us It is a neat pamphlet of over 300 pages, and gives details of all the departments of the city government. The engineering departments contain many indications of the skillful management of F. W. W. Doane, C.E., the city engineer.

A very attractive pamphlet describing the city of Hartford, Conn., and its principal industries has been published, describing, among other concerns, the Skinner Chuck Co. The sketch shows that the business of this company has developed very rapidly since its establishment in 1887, a development evidently due to the superiority of the firm's products. The company have several patents on their chucks, which are turned out on the most modern machinery by skilled workmen. The Skinner Chuck Co. have an extensive trade all over the continent, including Canada, and will be glad to furnish information about their specialties to those interested.

We have received a pamphlet from the International Correspondence Schools, of Scranton, Pa., which contains 1,000 letters written by friends of the school to testify their appreciation of the advantages it offers.

We notice from the calendar of the Kingston, Ont., School of Mining that the entrance examinations for the session 1897-98 begin Sept. 16th.

Industrial Notes.

The school trustees of Oxford, N.S., have decided to erect new school buildings to cost $7,950.

The town engineer of St. Stephens, N.B., has been authorized to invite tenders for sewers, for which the sum of $5,000 has been appropriated.

The E B Eddy Co., of Hull, will put in a separate system of waterworks, having 40 hydrants, with a pumping force of 5,000 gallons per minute.

The Joliette Lumber Company's mills at St. Gabriel de Brandon, is handling pulp wood at the rate of 50 cords barked per day, besides cutting 50 to 60 thousand feet of lumber daily.

A large number of elevator owners in Manitoba and the North-West generally are looking into the possibilities of gasoline engines, and several have already been ordered, it is said.

Drummond, McCall & Co., Montreal, who have the contract for St. Lambert's waterworks system, will employ from 100 to 150 men until the completion of the contract in November.

A E Whitehouse has commenced business at 684 Craig street, Montreal, as a general machinist and engineer, giving special attention to gas engines, printing machinery, bicycle work and model making.

The St Lawrence Foundry Co., Toronto, is now building a full line of fire hydrants, gate and check valves, and some waterworks appliances not hitherto made in Canada. A further reference to the firm's products will be made in our next issue.

A Cushing & Co offer to erect a pulp mill of a capacity of twenty tons per day, near their big saw mill at the St. John Falls, if the city of St John will supply the water free The mill would cost $150,000, and will pay out $60,000 a year in wages.

The third annual meeting of the shareholders of the Taylor Hydraulic Air Compressing Company, Ltd., was held at the offices of the company, 183 St. James street, Montreal, last month, and the following were elected directors. Samuel Carsley, president, Joseph B. Fair, vice-president, George Durnford, William H. Campbell and R. L. Murchison.

McOuat & McRae founders and machinists, Lachute, are getting very busy on orders for their specialties. This firm make a patent frost dog and patent timber gauge for lumber manufacturers, both of which are coming into general use as the best thing of the kind yet invented. They also make a "stuff" pump for paper mills, which is now used by all the leading paper and pulp mills of Canada. These and stationary fire pumps and friction clutches are among the special lines made by this progressive firm.

Hamelin & Ayers, of Lachute, Que., are building a large dam across the North River below their present woolen mills. Forty men are employed on the dam, which is 360 feet wide, 28 feet high from the river bottom, with a base of 84 feet. It is of the "beaver" type and gives a head of 23 feet at the dam, or by carrying the water across a peninsula formed by a bend in the river the head can be increased to 33 feet The work will be finished this month, and the owners will sell or lease the power for manufacturing purposes.