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The Canadian Engineer

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CONTENTS OF THIS NUMBER:

MASONRY PIER MOVED BY ICE AND REPLACED.*

BY R. W. LEONARD, M. CAN. SOC. C.E.

During the winter of 1895-96 the masonry for the four spans of the bridge which carries the St. Lawrence and Adirondack Railway (since leased to the New York Central and Hudson River Railway) over the Chateauguay River, Province of Quebec, was constructed.

The river at the crossing is 600 feet wide, and is spanned by four through steel spans of 150 feet each. The river is from 8 to 12 feet deep at low water, the bottom being clay, with some gravel in places and a few scattered boulders.

The abutments were built on shore; 75 piles were driven through the ice for each pier, and cut off by hand with a cross-cut saw carried in a light, stiff hardwood frame, just above mud-line. Field stone were filled in between piles to a level with top. A caisson was framed with double 12 x 12 bottom caulked, and double plank sides with tar paper between the planks, and sunk in place by the masonry as it was built inside. Rip-rap was finally placed round the piers to a height above the timber platform to prevent scour.

The abutments and two westerly piers were completed and two spans erected and resting on them. The easterly pier was just erected and two men were pointing the masonry on a warm spring day, when the ice shoved in the river and went out very suddenly. The winter had been exceptionally severe, with but little snow-fall, and the ice was strong, especially where it had been worked on all winter close to the bridge, at which place it was about three feet in thickness. A very large field of ice drifted down from the basin, lodged against the west shore and the westerly piers and swung against the unfinished pier, striking it obliquely on the westward side of the ice-breaker.

The field of ice was immediately broken in pieces by the piers and passed on, apparently doing no damage. On close inspection and measurement, however, I found that the easterly pier had moved out of position.

To replace the pier I built a crib as shown on the plan, sunk it in place, drove a row of piles behind it, loaded the top of crib with stones, and set four hydraulic 50-ton jacks between crib and pier. These moved the pier two inches, and the bottom of the platform then stuck on the head of the corner pile from which it had been pushed. A diver, who had been employed to remove the rip-rap around the pier and to examine the foundation, was instructed to cut this pile down half an inch, and a second and successful attempt was made with three jacks, two of 100 tons and one of 50 tons capacity. The pier was moved back to its proper position without showing the slightest crack in the pointing, or any other damage.

Additional rip rap was placed around the pier, the crib removed and piles cut off close, at a total cost of about $800.

There has been no further difficulty.

The weight of the pier is about...960,000 lbs. in air
Hemlock platform " ..... 50,000 "

1,010,000 " or 500 tons

Plan shows level of water when ice moved, and level of water at time when pier was replaced.

The facts may be interesting to Canadian engineers, as they show the dimensions of the masonry and the conditions existing in the case of a pier that just moved, and the force necessary to shift it on its foundation.

WEIGHTS ON FOUNDATION WHEN PIER WAS PUSHED BY ICE.

S.G. Limestone = 2.7

S.G. Hemlock = 0.7 say:

5/6 of masonry submerged say, therefore

Weight of pier at H.W.M. would be $\frac{960,000}{6}$ 160,000 lbs.

$+\frac{17}{27} \times \frac{5}{6} \times 960,000$ 503,700

663,700

Less flotation of platform 3/10 × 50,000. 15,000

Net weight of east pier when pushed by ice 648,700

150-foot span weighed about 350,000 lbs., therefore weight on piers not moved would be

Centre pier 648,700 × $\frac{350,000}{2}$ 823,700

West pier 648,700 × 350,000 990,780

WEIGHT ON FOUNDATION WHEN EAST PIER WAS REPLACED.

½ masonry submerged.

weight of pier would be ½ × 960,000 480,000 lbs.

$+\frac{17}{27} \times \frac{1}{2} \times 960,000$ 302,222

782,222

Say 391 tons.

*From a paper read before the Canadian Society of Civil Engineers.

Moved by 4 jacks of 50 tons, 200 tons.
Approx. co-efficient of friction, say ⅓ to 0.5 about.
Moved by 2 jacks of 100 tons and 1 of 50 tons, 250 tons.
Approx. co-efficient of friction 0.65.

Taking co-efficient of friction at ½, the thrust of the ice was about $\frac{648,000}{2}$ or 166 tons, or about 11 tons per square foot considering the ice three feet thick and striking the pier obliquely on a width of 5 feet.

THE STORAGE BATTERY FOR RAILWAY TRACTION.

As early as 1880, experiments in connection with storage battery traction were made in London, Paris, Brussels, Birmingham, Hamburg, New York, New Orleans, Washington and Dubuque. The short life of the batteries and the enormous expense of renewing the positive plates, resulted in failure, the battery quickly deteriorating under the care of the ordinary railway employees. In theory, as the Street Railway Review remarks, the storage battery did present many ideal conditions. "It provided a self-contained motor car with no outside accessories, as trolley lines, feeders, bonds for the transmission of the current. The electric current could be generated in a station free from overloads and troublesome peaks, at certain times of the day, and thus the station need only be of minimum capacity for the work required."

In Europe.

E. A. Ziffer, C.E., of Vienna, Austria, president of a local street railway, in an address before the International Street Railway Association, which met in Geneva last summer, reviewed all the present systems of mechanical traction, and sums up his conclusions in reference to the storage battery system in these words: "Accumulator traction, which might be considered the ideal, is still in the experimental stage, in spite of the good results already obtained. It continues to be a subject of great interest, and has a hopeful future." The weight of the batteries has always been a detriment to the working of the storage battery system of traction. Mr. Ziffer gives the weight of the battery, with all accessories, capable of operating a double truck car, weighing 12½ tons, English, for a distance of 9½ to 12½ miles, as 1.2 tons, English. The Ribbe Accumulator, which has been tested on one of the lines in Berlin, is lighter than the usual type, the weight for a capacity of 300 amperes-hours at a pressure of 260 volts, being 3.4 English tons. Even this is very much heavier than the batteries which are being made in Canada, which were mentioned and illustrated in our October number; but notwithstanding the enormous weights of the European and American batteries, very satisfactory progress has been made on both continents. The Wurtemburg State railways are making an important test of the value of storage batteries for traction purposes, and have put in operation near Stuttgart, on a line 14½ miles long, a storage battery car seating 48 passengers, the battery having 188 cells, weight, 5.8 tons (weights are stated in English tons), and giving a capacity of 16,000 watt hours. In a test made in September, 1897, with this car, which weighed, with passengers, 28.75 tons, the current consumption was from 29.34 to 30.45 watt hours per ton mile, at an average speed of 19 miles per hour—a very satisfactory result. Similar experiments are being carried on in Belgium on the Brussels-Liege line. In Paris, 35 storage battery cars are in use, the batteries alone weighing 3.5 tons out of a total of 14 tons per car, loaded with 52 passengers. The time of charging the batteries is from 8 to 12 minutes. The battery contains 54 ampere-hours. The Ostend Tramway is operated by accumulators.

Since March, 1896, two accumulator cars have been in use on the narrow gauge lines near Darmstadt. The cars carry 32 passengers, and weigh, without passengers, 8.1 tons, of which the battery weighs 2.3 tons. The plates are of the Plante type, and have a capacity of 30 ampere-hours, with 4.20 volts, average E.M.F. From April, 1896, to August, 1898, these cars made an average of 62.14 miles per day, and the consumption of current has been 645 watts per car mile. Up to the spring of 1897, no trouble had been experienced with these cars, therefore the Railway Commissioners decided to install some larger cars, which will soon be in operation. In May, 1897, two 24.4 ton motor cars were put in operation on the Ludwigshafen, Neustadt & Worms lines, having a total length of 32.3 miles. Each car weighs 11 tons, battery, 9.3 tons; motor and accessories, 4.1 tons. A single charge of the battery makes the round trip at an average speed of 15½ miles per hour. Each car carries 36 passengers, and draws one trailer carrying 50 passengers. The cost of operation, including wages of conductor and motorman, fuel, oil and waste, is 28.65 cents per train mile. On the Frankfort-on-Main tramway, the battery weighs 2 tons, and the empty car, excluding the battery, weighs 6 tons The battery is stored in 4 or 5 minutes, and this charge lasts for short round trip of half an hour. In Munich, where the overhead trolley is not allowed, a storage battery locomotive is about to be put in operation, to draw a trail car. On the Berlin-Charlottenburg line the battery consists of 180 cells of 260 ampere hour capacity. The car body and truck weigh 19,316 lbs., battery, 15,048 lbs.; 2 motors, with gears, 3,300 lbs.; total, 37,664 lbs. When loaded with 42 passengers, total weight is 43,000 lbs. With the battery on this car it makes ten round trips a day, covering 90 miles a day, at an average speed of 9.3 miles an hour, but 14.25 miles per hour is the best performance.

While the overhead trolley system is the one most generally adopted in Europe and America, and in the opinion of Mr. Ziffer is the most simple, the most economical, and the one which has given in practice the best results up to the present time, he concedes that "It is a very difficult thing to say which among all the mechanical systems of traction is the most desirable from an engineering and economical standpoint. It is necessary to take up each condition individually, and weigh carefully all the relative circumstances in construction and operation."

The list of systems is now rather extensive, and may be grouped as follows: Steam—Rowan, Serpollet, Clark systems; Stored Steam Locomotives—Lamm-Francq & Dodd systems; Compressed Air—Merkarski, Popp-Conti, and American Air Power Company's system; Gas Benzine and Petroleum Motors—Lubrig, Daimler and Diesel systems. There are, also, the cable system, the overhead trolley, the electric conduit, the surface contact, the third rail, and the mixed electric systems—combination of accumulators, and overhead,

In America.

During the past five years, experiments in accumulator traction were made on a commercial scale in New York, under the auspices of the Julien Company, which for a considerable time operated 10 or 12 cars on the 4th avenue road. Trials more or less successful were also made in Philadelphia, New Orleans, and the other American cities, above mentioned. The most successful storage battery road in operation in the United States is that of the Chicago Electric Traction Company, which runs a line about 20 miles long between Chicago and Englewood. There are no stations on the line along the route, the entire line being within the city limits, although the most of it is through only sparsely-settled territory. The cars are required to stop at all street crossings to let off and take on passengers. The batteries weigh 3½ tons per car, each battery consisting of 72 cells, and having a capacity of 400 ampere hours, while the weight of car, equipped with batteries ready for use, is 16 tons. The weight of rail is 80 lbs. Eight regular cars run on week days, but on Sundays and holidays as many as 40 are used, including trailers. Owing to the weight of the cars, they cannot be started and stopped as quickly as a trolley car, which only weighs 8 or 9 tons; but this inability results in more care on the part of the motormen, who always pass vehicles with the power shut off, giving them a better opportunity to use the brakes. The "accident account" is surprisingly low, only two-thirds of one per cent. of the gross receipts, while the usual rate for a suburban trolley line is 2 per cent. Motormen are trained to "coast" as much as possible, the weight of the cars enabling them to coast faster and further than would be otherwise the case. Snow storms have been successfully handled with but one plough, weighing 22 tons, and one sweeper, weighing 26 tons, for 26 miles of track. The manager, E. R. Gilbert, who was formerly connected with trolley lines, reports that he got more work out of these appliances than he had ever seen accomplished with machines operated by trolley. In one case they cut through a drift 7 feet high, and several hundred feet long, by "bucking" the drifts with a plough. Cars have been run 40 miles on one charge, but the conditions for such a long run are so often unfavorable that it has been found advisable to change the batteries every half trip of 11 miles, the power-plant being located in the middle of the system. By doing this, cars are able to carry trailers and make the trip under all conditions. Passengers do not seem to mind in the least the slight delay caused by changing the batteries, which takes only 1¼ minutes. The road-bed is nearly level, except one hill about 300 feet long with a grade of 9½ per cent. With a dry rail the cars easily climb the hill without assistance. In one instance, two loaded trailers were hauled, a counter-weight system being provided to prevent accidents and slipping.

"Our cars average over 200 miles per day," Mr. Gilbert says, "at an average speed of 12 miles per hour. Passengers, one and all, agree that riding on them is much more pleasant than on any other system, as the cars ride very smoothly, owing to their weight, without the unpleasant noise of the trolley or the jerking of the cable system. The advertising resulting from these conditions is worth considering." An element of importance is the fact that the whole line cannot be shut down at once, as all cars are independent of each other. There is no necessity for a wrecking wagon, as a wrecking car can always be sent out, as on a steam road. The steam plant (power-house) is also more independent than on a trolley road, as it can be shut down two or three hours without interfering with the service in the least. Current for lights in the office, barn and power-house is taken direct from the batteries, therefore there is no necessity to run the plant all night. It is closed down at 11 p.m., although the last car does not reach the barn until nearly 1.30 a.m. The load on the engines and dynamos is always constant.

Wear and tear on trucks, wheels, roadbed, and special work is very much heavier than on a trolley system, because of the great weight of the cars. We use an 80-lb. girder rail and all crossings, etc., are made extra heavy, but even then the cost of maintenance is very great. The depreciation of the batteries is 2c. per car mile, as against the depreciation of overhead work and rail bonding on a trolley road, which would amount for similar mileage to about $4,325 per year. Operating expenses average 8 2-3c. per car mile, comparing favorably even now with those on trolley systems, but the difference will be greatly in favor of the battery line, as the service on the latter grows towards the capacity for which the plant was built. "I see no reason," Mr. Gilbert adds, "why a storage battery system under fair conditions cannot be operated fully as cheaply as a trolley line." Taking a basis of 20 cars, and the mileage of the Englewood road, the difference in cost of construction of that particular road would be only about $25,000 in favor of the trolley system. To offset this slightly greater expense is the unquestionable advantage of having no overhead work of any kind to mar the appearance of the streets through which the road runs, or to add the element of danger to the public from live wires or electrolysis.

The numerous facts and data cited by Mr. Ziffer, as to the installation and operation of various systems in different parts of Europe, show that the accumulator, or storage battery, stands well the test of comparison. The following table is very interesting and instructive in this connection. It is given by Mr. Gofferneaux in his work on "Mechanical Traction for Tramways," and is a theoretical comparison of the cost of the different systems, including 10 per cent. fund for depreciation on the capital invested, and based upon an annual traffic of 621,382 car miles. The figures are in cents per car mile.

System of Traction.	Operation.	Depreciation.	Total.
	c.	c.	c.
Serpollet (steam)	9.7	3.5	13.2
Rowan (steam)	11.3	3.5	14.8
Electric accumulators	10.9	4.2	15.1
Trolleys	10.0	5.5	15.5
Gas motor	13.9	3.5	17.4
Compressed air	13.55	4.85	18.4

It will thus be seen that in point of economy, electric accumulators are superior to the popular trolley, while compressed air is at the foot of the list.

Reduction in the weight of batteries would materially lessen the cost of construction in a storage battery railway, as lighter cars, rails, and equipment generally could be employed. In competition with the trolley, the construction of which costs per single mile, according to Mr. Pearson, of New York, $16,650,

the storage battery ought to have a good fighting chance on the trolley's own ground. We would suggest to the engineers whether it might not be possible to devise a simpler and lighter system of construction, taking into consideration the particular necessities of the case, that will fill the conditions required in this wooded country, in the more sparsely-settled districts, and in connection with mining and lumbering camps.

—The report on the gold deposits in the Province of Quebec just issued by J. Obalski, the Government mining engineer, which bears date June, 1898, is a pamphlet of some hundred pages which gives a very interesting historical outline of the gold mines of the Chaudiere valley, which are now the property of the De Lery family, being part of the famous seignorial grants of Rigaud-Vaudreuil of 1736, to which the gold rights were added in 1846, and comprise 71,000 acres divided into thirteen mining sections.

—The report of the street commissioner of St. Louis, A. N. Milner, is an interesting and beautifully illustrated publication, which shows the present position and progress of the city. We learn that the population is now 651,821, and the bonded debt is $19,959,278. The city bridges have cost, with approaches, $1,513,618. The macadam of the improved streets costs $16,500 per mile in St. Louis, but the curbs and gutters are either of brick laid on concrete or granotoid, which of course adds enormously to the wearing and serviceable qualities of the road-bed. One-half the lanes in the city have been paved at a cost varying from $30,500 per mile for granite blocks to $12,000 per mile for limestone blocks.

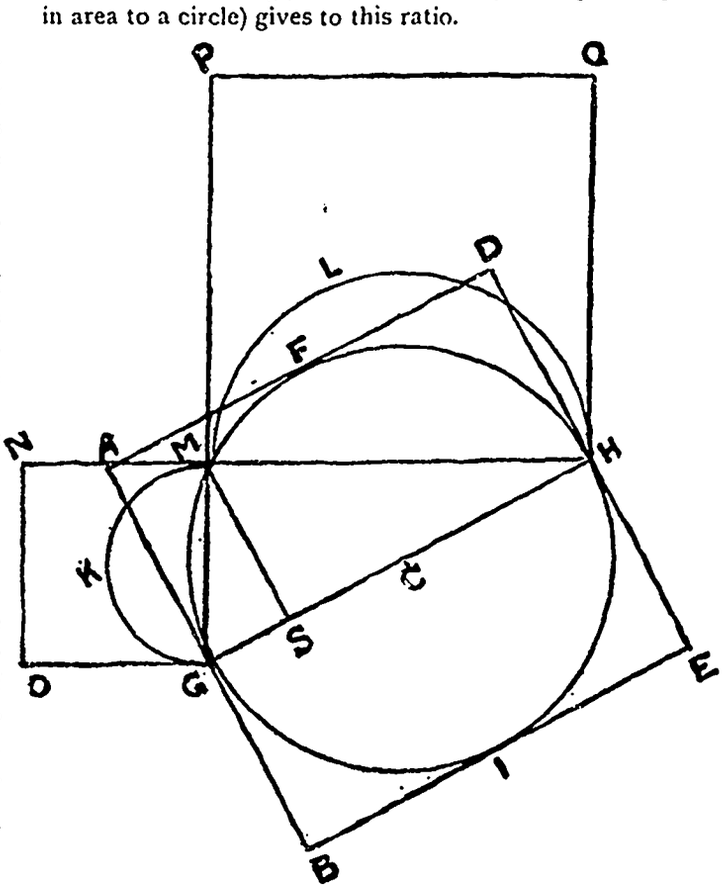
—The report made by C. H. Rust, city engineer of Toronto, on the subject of sewage disposal with reference to the present undesirable conditions in Toronto, contains a great deal of information in a concise form. But we think some of the methods of disposal might have been more fully discussed, nor do we quite see that the matter narrows itself down to intermittent filtration at a first cost of $1,730,000 and an annual charge of $70,000; or precipitation works at a first cost of $1,540,000 and an annual charge of $105,000, as the Toronto engineer concludes. Any conclusion in the matter of sewage disposal is most unwise until the Royal Commission appointed by the Imperial Government has made its report, which will be prepared after examining the promoters and operators of all known systems upon oath. Any town which goes to the expense of asking its own engineer to prepare a report on the subject in the meantime is merely wasting its money, because no engineer can examine all known systems himself, nor can he ask questions which are sure of truthful answers from the promoters, because they are not upon oath.

TO SQUARE THE CIRCLE.

The following criticism of the recently published solution of the old problem has been written for THE CANADIAN ENGINEER by one of the most able mathematicians in Canada, one who is considered an authority on mathematics and kindred subjects, throughout the continent:—

E. Stone Wiggins, B.A., M.D., LL.D., of the civil service, Ottawa, is to the front with what he believes to be a successful squaring of the circle. Unhappily for him he is no more successful than others who in modern times have battered what they were pleased to call their brains against this problem. Mr. Wiggins says there were four problems for which the ancient mathematicians in vain sought solutions: (1) Squaring the circle; (2) trisecting any angle; (3) duplicating the cube; and (4) finding two geometrical means between two given straight lines. Had "Professor" Wiggins known more of mathematics than he does, he would have been aware that (3) and (4) are one and the same problem. And again, had he had a slight knowledge of mathematics he would have known that the accuracy of tables of lines and tangents does not depend on the size of any circle to which the angle may be conceived as having reference. The "Professor" seems to think the numerical values of the trigonometrical ratios are determined by measurement with a carpenter's rule.

But to come to the squaring of the circle. It would be too dreary a labor to go through his reasoning and point out where the fallacies creep in. Fortunately there is a more expeditious way of disposing of the "Professor" and his demonstration. The ratio of the circumference of a circle to its diameter, 3.14159...., has been found approximately with absolute certainty. There is nothing more certain in science than that this is the approximate value of this geometrical constant. It has been determined in countless different ways, and always with the same result. It will therefore be sufficient for us to examine what value Mr. Wiggins' construction (for a square equal in area to a circle) gives to this ratio.



Referring to his demonstration and figure, it will be seen he claims that the square on MH is equal in area to the circle. But

$$MH^2 = \frac{GH^4}{AH^2} = \frac{16\,(\text{radius})^4}{5\,(\text{radius})^2}$$

$$= 3.2\,(\text{radius})^2$$

and area of any circle = (ratio of circumference to diameter) × (radius)². Hence if, as the Ottawa philosopher claims, MH^2 = area of circle, we shall have ratio of circumference to diameter of a circle = 3.2, instead of 3.14159...., which latter it certainly is.

If it be urged as an objection to the preceding, that it shows Mr. Wiggins to be wrong, but does not show where he is wrong, the reply is that it disposes of his pretentiousness in an expeditious manner, and that in going thus far we have accorded to him more consideration than his exhibition of ignorance is entitled to.

We append the demonstration of the problem of squaring the circle which E. Stone Wiggins, B.A., M.D., LL.D., Ottawa, has recently published. On another page will be found a criticism of the demonstration:

CONSTRUCTIONS AND DEMONSTRATIONS:

Let F G I H be any given circle having its diameter G C H. About this circle describe the square A B E D touching it at the points F G I H. Join A H, cutting the circle at M. The square on M H is equal to the given circle F G I H.

Because G H is double G A, and the triangle M G H is similar to the triangle G A H, therefore, the side M H is double M G. Hence the triangle M G H equals the square on M G.

On M G describe the square M G O N which will be spoken of as the square on M G. On M H describe the square M H Q P which will be spoken of as the square on M H. Also, on M G, as diameter, describe the circle M K G which will be spoken of as the inscribed circle of the square on M G, or the circle on M G. Similarly describe on M H as diameter the circle M L H which will be spoken of as the inscribed circle of the square on M H, or the circle on M H.

It is evident that some straight line may be drawn from the point H to meet the arc G F, the square on which will equal the given circle. Let any line M H be by hypothesis this straight line.

Now, since the square on M H—the same construction being made—is equal to the given circle F G I H, it is equal to the two circles on M G and M H because these two circles equal together the given circle. Therefore, the circle on M G equals the rim of the circle on M H, that is the part of the square M H Q P which is outside its inscribed circle.

From the point M let fall the perpendicular M S upon G H.

Now, the circle on M H is to the circle on M G as the triangle S M H is to the triangle S G M for they are similar figures described on M H and M G, the sides of the rightangled triangle M G H. Therefore, if the triangle S M H were formed into a circle the triangle S G M would become its rim in the same way that if the square on M H were formed into the given circle—for by hypothesis it is equal to it—the square on M G would become its rim. Hence, the rightangled triangle M G H must be the only triangle that can be described in the semi-circle G F H which is so divided by its perpendicular M S, that its parts, the triangles S M H and S G M, will have the same relation to each other as the circle has to its rim.

To square the circle geometrically, it will be necessary:

1. To divide the given circle into two circles, having the same relation to each other as the circle has to its rim.

2. To divide the rim of the given circle into two parts, having the same relation to each other as the circle has to its rim.

Then the smaller circle of the former pair will equal the larger figure of the smaller pair.

To illustrate from the figure: If the square on M H equals the given circle then the latter is divided into two circles, the circle on M H and the circle on M G, which are to each other as the circle to its rim; also if the triangle M G H is equal to the rim of the given circle, it is likewise divided into two parts by its perpendicular M S, the triangle M S H and the triangle M S G, which are to each other as the circle is to its rim. Or to express it in proportionals to meet the above two conditions, the circle on M H is to the circle on M G, as the triangle M S H is to the triangle M S G, in which the triangle M S H is equal to the circle on M G. That is, the circle on M G equals the rim of the circle on M H.

The reason the square on M H is equal to the given circle is that it is made up of the circle on M H and some regular figure also described on M H, and, which happens to be made by the construction, equal to the rim of "the circle on M H."

It will be noticed that the construction transfers the circle on M G from the left side to the right, forming the rim of the circle on M H, while it is represented on the left by the triangle S G M, which is really described like itself on M G.

Since the square on M H is by hypothesis equal to the given circle, it is the same multiple of the triangle M G H, which is described in the semi-circle of the given circle, as the circle on M G is of the triangle S G W, which is described on its semi-circle, because these are similar triangles. But the rim of the circle on M H being equal to the circle on M G, it is also the same multiple of the triangle S G M, demonstrating that the triangle S G M or its multiple is transferred from left to right and added into the square on M H. The rim of the circle on M H being, as already shown, equal to the circle on M G, it must be that it is the same multiple of the triangle S G M, that the triangle S M H is of the same triangle. That is, the triangle S M H is equal to the rim of the circle on M H, and therefore equal to the circle on M G, for they are both described on the side M H. The triangle S G M must then be equal to the rim of the circle on M G, and the triangle M G H must equal the rim of the given circle.

Because the square on M G may be either greater or less than the triangle M G H, according to the position of the point M in the arc G F, let the triangle M S H be by hypothesis equal to the circle M G. Now the circle on M G is to the triangle S G M, as the circle on M H is to the triangle M S H. Therefore the given circle (that is the two circles), is to the triangle M G H, as the circle on M G is to the triangle S G M, but the circle on M H and the triangle S M H are equal to the given circle. Therefore they are together to the triangle M G H, as the circle on M G is to the triangle S G M. Hence the circle on M H plus the triangle S M H, are to the circle on M G as the triangle M G H is to the triangle S G M.

But in the construction, when the square on M H was by hypothesis equal to the given circle, the latter was the same multiple of the triangle M G H, as the circle on M G was of the triangle S G M, and this would be true whatever be the position of M in the arc G F. When, therefore, the square on M H becomes equal to the given circle, it is the same multiple of the triangle M G H, as the circle on M G is of the triangle S G H. Hence the square on M H is to the circle on M G as the triangle M G H is to the triangle S G M, the same as in the previous construction. They must then be of the same construction. Therefore, when the square on M H is equal to the given circle the triangle S M H must be equal to the circle on M G. Then the triangle S G M is the rim of the circle on M G, and the whole triangle M G H is equal to the square on M G. That is, the side M H is double the side M G, as in the original construction. The square M H Q P in the original construction is therefore equal to the given circle F G I H.

The two conditions mentioned are here fulfilled for the triangle M G H, the rim of the given circle is divided into two parts, related to each other, as the circle to its rim. The given circle has also been similarly divided and the larger of the former equals the smaller of the latter.

That the circle on M G is transferred from left to right, forming the rim of the circle of the square that equals the given circle, or, rather that the rim of the circle in the square on M H is to the triangle S G M as the circle is to its rim; also, that by assuming that the triangle S M H is equal to the circle on M G, the regular figure on M H is increased by the circle on M G, produce H D to meet M P produced in the point V. Now, because the triangle S M H on the longer side of the triangle S G M is equal to the circle on its hypotenuse M G, so also must the similar triangle M H V, described on the longer side of the triangle M G H, be equal to the circle on its hypotenuse G H, that is, the given circle. Now, it will be seen that if a perpendicular M W be drawn to the base, H V, that the triangle H M V will be divided into two triangles, W M V and M W H, and these triangles are to each other as the triangle M S H is to the triangle M S G, that is, as the circle on M H is to the circle on M G. But the triangle M W H equals the triangle M S H, for they are similar and have the side M H in common, and the latter is equal to the circle on M G, therefore, the two triangles M W V and M W H are equal to the two circles each to each. The triangle M H V, therefore, must be equal to the square on M H in the same way that the circle on M H together with the triangle S M H are equal to the square on M H which equals the given circle.

Again, let the square on M H be equal to the given circle, and in the semi-circle M L H describe the rightangled triangle M L H equal to the rim of the circle on M H. Describe, also, the rightangled triangle M K G in the semi-circle M K G equal to the rim of the circle on M G. These triangles should be described on the upper side of M H and M G and on a separate sheet, as they would if drawn in the cut here given render it difficult and obscure. These should be similar to the triangles

S M H and S G M, the real triangles, which are turned down to form the triangle, M G H. Produce H L to meet M P in R. Since the rightangled triangle in the given circle to be equal to the rim of the given circle must be similar to the triangle M L H and equal to these two triangles, and must also be described on its diameter, G H, therefore, the base, H R, must equal G H. Hence the triangle, M G H, must be the rim of the given circle.

Lastly, it will be observed that as the apex M, of the triangle M G H, is moved along the arc G F, the area of the lunes G K M and M L H will increase or diminish as M approaches or recedes from F. These lunes, known as the Lunes of Hipparchus, are always together equal to the triangle M G H. Now there must be some point in the arc G F, where M may be placed so that the quadrilateral P G H Q, will be equal to the irregular circle G K L H I (made up of the given circle and the lunes), when the square H Q P M will, of course, be equal to the given circle. This can only happen when the lunes are equal to the square on M G. It will be observed that the lune G K M is always a part of this square, and that it is only when the remainder, after it is deducted, is equal to the larger lune, that the two lunes can form a square. But when the square on M H is equal to the given circle, the triangle M G H, to which they are equal will, as already demonstrated, form a square. But in the original construction the triangle M G H, to which the two lunes were equal, was equal to the square on M G, showing that the two lunes formed this square. Hence the latter construction must be the same as the original and the square on M H in the original construction is equal to the given circle.

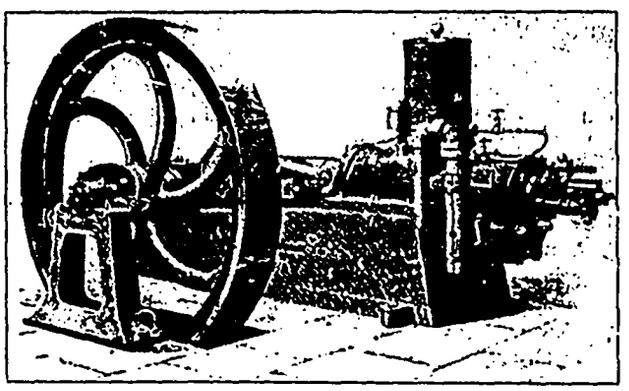
LOVE PUT OUT THE LIGHT.

The North Shore Power Co., which is supplying electricity for the city of Three Rivers, is generating it at Batiscan Chute and stepping it up to 12,000 volts for the purpose of a 16 mile transmission. A few evenings ago just as the dusk was coming on and the heavy load beginning to show on the ampere meters, the circuit breakers flew, the fuses blew and the lights were out. This lasted for perhaps ten minutes when the lights again started up and ran satisfactorily. The day following, the electrician naturally investigated to see what caused the trouble, and he found that a window had been broken in the sub-station at Three Rivers, and that some of Jean Baptiste's chickens had sought a roost on the bare copper wire, and as Chanticleer kissed Biddie "good-night" it completed the circuit, electrocuted the lovers and put the lights out.

This, perhaps, is one of the most uncommon short circuits or reasons for trouble that has occurred in Canada, and is a pointer for other electricians who may have power houses with broken window panes.

THE "CAMPBELL" ELECTRIC LIGHTING TYPE OIL ENGINE.

The Campbell Gas Engine Co., Ltd., Halifax, Eng., the largest maker of oil and gas engines in the world, having been called upon to supply several of its oil engines for electric lighting purposes, has decided a short time ago to introduce an oil engine specially for this work, which has proved a great success. To absorb the irregularities in speed due to the peculiarities of the "Otto Cycle," on which all oil engines are constructed, and the irregularity caused by changes in load, the Campbell Company states, the special engine is fitted with one heavy fly-wheel of large diameter. The crank-shaft is provided with a third or outer bearing, so preventing any undue strain being put on the shaft, which would be the case if the fly-wheel was unsupported or over-hung. The moving parts of the engine are balanced as nearly as possible by weights fixed rigidly on the crank webs. Automatic lubrication is provided for the crank pin, so that long runs can be made without stoppages for oil purposes. The engine is also provided with a special governor, driven direct from the crank-shaft of the engine, independent of other gearing by means of skew-gear wheels with machine-cut teeth. Every detail of the engine has been carefully studied to fit it for exacting and continuous work. It is provided with a special splash cover over the crank, and oil trays are fitted to the bed to catch the waste oil. From experiments made with these engines the makers state that variation in speed does not exceed two per cent., so that these engines can be relied upon for the steady running of incandescent lamps.



THE "CAMPBELL" ELECTRIC LIGHTING TYPE OIL ENGINE.

"A large installation has recently been put into the New Palace Theatre just erected at Plymouth, Eng.," says an article in The Electrical Review of October 28th, 1898. "The installation consists of 1,200 incandescent lamps and six Jandus arc lamps. On the ground floor are fixed four 25-30 brake h.p gas engines made by the Campbell Gas Engine Company, Ltd., Halifax. These engines have been specially designed for the driving of dynamos, with governors actuated direct from the crankshaft. Each engine has one large, heavy fly-wheel, weighing about two tons, and measuring 6 feet 6 inches in diameter. The engines are all arranged with their fly-wheels nearest the walls of engine room to allow plenty of room for the man controlling the plant. Each engine is fitted with a patent self starter. All the four engines can be got up to full speed within a quarter of an hour. The cooling of the cylinders is done from three rectangular tanks, having a total capacity of 3,600 gallons. A large main feed to the engines and one common return, to which each engine is connected, ensure a perfect cooling arrangement The difficulty of space has been well got over in the arrangement of the water tanks. The exhaust of each engine is carried to the top of the theatre roof, about 60 feet high, with a 3½-inch pipe, and passed through an exhaust box and silencer, the noise from the exhaust being effectually silenced. These engines drive four shunt wound dynamos erected on the first floor immediately over the engine room, the arrangement of cross driving allowing 18 feet between engine and dynamo centres. The dynamos are driven by special laminated leather belting. Three are wound for an output of 145 amperes at 110 volts, and the fourth for 100 amperes at 150 volts. The average load of the installation is 500 amperes per hour for four hours at 110 volts. Therefore 55 x 4 equals 220 units per night; 220 x 6 equals 1,320 units per week. The gas for the four 25 brake h.p. gas engines passes through a 400 light meter; the gas consumption per night averages 7,000 cubic feet, and the Plymouth Gas Company's charge is at the rate of 1s. 9d. per 1,000; 7,000 at 1s. 9d. per 1,000 equals 12s. 3d. per night, or £3 13s. 6d. per week. The cost of production is therefore:

42,000 cubic feet of gas per week at 1s. 9d. per 1,000	£3 13s. 6d.
Gas engine man's attendance at £1 5s. 6d. per week.	1 5s. 6d.
One dynamo attendant at £1 2s. 6d. per week	1 2s. 6d.
Oil, waste and engine sundries	12s. 6d.
For 1,320 units	£6 14s. 0d.

From the above figures it will be observed that these large engines are working for 18s. 6d. per week each engine, or 1¼d. per unit."

—The New York Independent, the leading weekly newspaper of the world, and one whose pages exercise the widest influence, is entering upon its fiftieth year of publication The Independent emphasizes its fiftieth year by changing its form to that of a magazine, and by reducing its annual subscription price from $3 to $2; single copies from 10 to 5 cents. The Independent, in its new form, will print 3,640 pages of reading matter per year, at a cost to subscribers of $2, while the prominent magazines, which sell for $4 a year, print only about 2,000 pages. The subscriber to The Independent gets 82 per cent. more of equally good reading matter at one-

half the cost! It is not only the leading family weekly newspaper, but by far the cheapest and best. A free specimen copy may be had by addressing, The Independent, 130 Fulton Street, New York.

THE CATARACT POWER CO., OF HAMILTON, ONT., LTD.

Saturday, November 12th, will go down in the electrical annals of Canada as a red letter day, as it will chronicle the formal opening of the electric power plant of the Cataract Power Company, Hamilton, Ltd., for the transmission of electrical energy from a point on the Niagara escarpment, near DeCew Falls, to Hamilton, a distance of 35 miles, the conception and carrying out of which must always stand as a monument of the business pluck and enterprise to those interested in and forming the Cataract Power Company.

Over three years ago, when the transmission of energy by electricity over long distances for commercial purposes was still in much of an experimental stage, the possibility of utilizing the magnificent fall of over 200 feet, obtainable at DeCew Falls, where the waters of the Beaver Dams creek tumble over the Niagara escarpment, for the generation of electrical energy to be transmitted to the city of Hamilton, 35 miles distant, suggested itself to John Patterson of that city. After numerous surveys and examining into the physical feasibility of the scheme, he associated with himself the Hon. J. M. Gibson, John Moodie, sr., James Dixon and J. W. Sutherland, all well-known citizens of Hamilton. Together they procured a charter and formed the Cataract Power Company of Hamilton, Ltd., for the purpose of the development of this power and the transmission of it to Hamilton. After the formation of the company, the ground was again gone over carefully, and it was found advisable to abandon the original idea of utilizing the waters and water-ways of the Beaver Dams Creek and the DeCew Falls, and by changing the plans, some very material advantages were gained: The securing of a supply of water, which would be constant, through a feeder from the Lake Erie level of the Welland Canal at Allanburg; the construction of a canal, 4¾ miles long, over private right of way, thus giving the company an unobstructed water-way; the securing of land along the private water-way for storage basins, by which the company can conserve its water at a period of non-use or light load for use at the time of heavy load; and by going three-quarters of a mile east of DeCew Falls along the Niagara escarpment an additional fall of 75 feet was obtained, which was a very valuable acquisition. At this point there were also exceptional natural advantages, both at the top of the escarpment for the anchorage of flumes, erection of penstocks, etc., and at the foot of it, for the discharge of the tail water, as well as a splendid site for the power house.

The hydraulic development, as it was desired by the Cataract Power Company, presented obstacles which, owing to the large units and to the high head, made it exceptionally difficult to secure a builder of waterwheels who would give what the hydraulic engineer's specifications called for. After a long delay and much negotiation the Stillwell-Bierce and Smith-Vaile Company of Dayton, Ohio, agreed to build special horizontal turbines of a capacity of about 2,000 horse-power each, to work under a head of 275 feet, and to operate at a speed of 400 revolutions per minute. This required, also, special valves and valve gear, and controlling devices, all of which were specially designed for this particular plant. The generation of the electric power and the transmission of the same from the power house to the city of Hamilton, a distance of 35 miles, presented at that time a seemingly insurmountable obstacle to the carrying out of the scheme, no transmissions of energy, such a long distance, for commercial purposes, having up to that time been undertaken. The largest electrical concerns, both in Europe and America, were consulted, but the limitation of a practical working pressure, sufficiently great to insure the transmission of power such a long distance, practically precluded the undertaking of the work by any of the companies consulted, the highest working pressure, up to that time, being not above 10,000 volts. At this working pressure the cost of the transmission line became so great that the Cataract Power Company did not feel warranted to undertake the development of the enterprise. The longer the distance, the heavier the conductor must be; therefore, to transmit over this long distance, it was necessary that the pressure be 20,000 volts or over, so that the cost of the conductor would be within the limit set, of allowing the Cataract Power Company to undertake the development of the enterprise. After nearly a year of futile attempts to have the work undertaken at a pressure which would justify them in proceeding with the work, and being unsuccessful, they consulted J. A. Kammerer, one of the staff of the Royal Electric Company of Montreal, and after careful consideration of the conditions and preliminary estimates of the work being made by him, and a working pressure of 24,000 volts guaranteed, the Royal Electric Company agreed to undertake the work which, with its consequent saving, brought the cost within the limits deemed necessary by the Cataract Power Company to admit of their proceeding with the work.

The first ground was broken on October 5th, 1897, and the work was pushed with such vigor that the current was sent over the lines, from DeCew Falls to Hamilton, on the afternoon of August 25th, 1898, or just 10 months and 20 days from the beginning of work.

THE CATARACT POWER CO.—AQUEDUCT OVER BEAVER DAM CANAL.

THE CANAL.

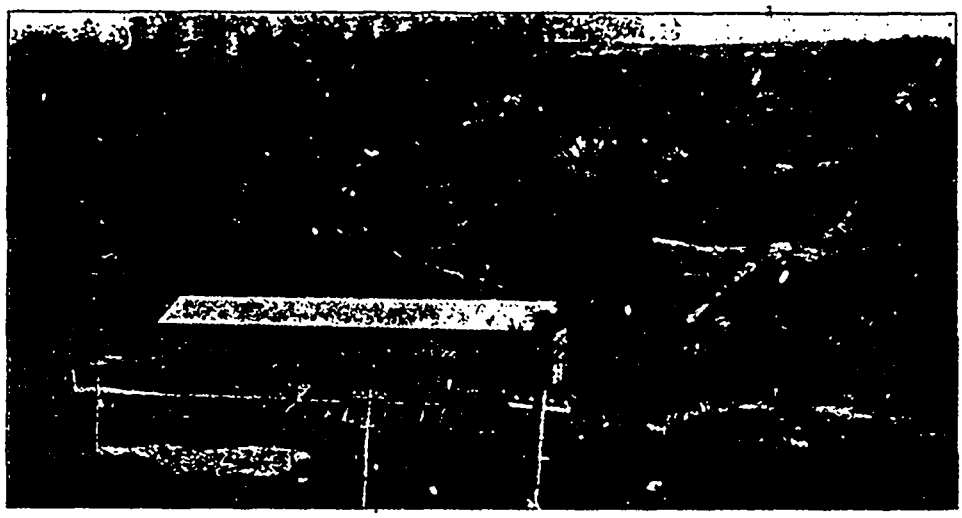
The water for this plant is secured through a feeder from the Lake Erie level of the Welland canal at Allanburg. The arrangement of the gates as shown in the illustration, is such as to admit of the unwatering of the lower levels of both the old and new Welland canals without interfering with the company's supply of water. From Allanburg the company has a private canal extending north-westerly to the edge of the Niagara escarpment, a total distance of about four and one-half miles. At three different points there are placed gates for regulating or shutting off the supply so that the water is under complete control. Where the canal crosses the Beaver Dams creek, the water is carried in a closed wooden flume supported on a steel truss. This flume is placed below the level of the water in the canal at each end so that the contained water is always under pressure, which is intended to prevent leakage. The water follows generally the water courses of a succession of small streams, consequently there are few heavy cuts or fills. In a number of places the contour of the ground formed a natural bed for the canal and no work was necessary. At the heavy cuttings, the banks to the bottom of the canal are pitched with stone and the important embankments are rip-rapped to prevent erosion.

At the lower end of the canal, near the mountain top, are located three large storage reservoirs, having a total area of thirty-three acres. These are sufficient to contain forty-eight

hours' supply of water and will meet the hourly inequalities of demand usual in electric supply companies, as well as allowing the unwatering of the upper stretches of the canal for repair purposes, without the interruption of the service. Throughout the whole length, the work is of particularly substantial character, the factor of safety being exceptionally large, and all the requirements of the service seem to have been carefully considered. The large reservoirs being located immediately at the mountain's edge, where the water enters a steel pipe, and the long stretches of slow current canal, it is expected will promptly freeze over and prevent any trouble from frazil or anchor ice. In this matter the water power is particularly fortunate, as there is practically dead water to Lake Erie The canal is designed to carry sufficient water to develop from 10,000 to 12,000 horse-power without creating an erosive speed in the current. The waterways and appurtenances were constructed under the supervision of Thos. E. Hillman, C.E., resident engineer, and under the general approval of Wm. Kennedy, jr., Montreal, engineer-in-chief.

THE PIPE.

At the brow of the mountain, the water is delivered through a concrete fore bay, protected by suitable racks and head gates, to a large steel pipe which carries it directly down the mountain slope to the power house, 260 feet below. The pipe is of steel plate, double riveted on both longitudinal and transverse seams. It is 745 feet in length and varies in diameter from 8 feet 6 inches at the top to 7 feet 6 inches at the bottom. The steel used for the top section is ¼-inch in thickness and gradually increases in size down the slope until at the bottom it is 13-16 of an inch.



THE CATARACT POWER CO.—POWER HOUSE AND PIPE LINE.

The weight of this pipe is all supported from the top, where a number of heavy flanges are built into several piers of concrete placed in the rock cutting. Down the slope, at intervals of fifteen feet, supporting masonry foundations are constructed. A substantial double housing of matched lumber is now being built over the entire length to protect the pipe from extreme changes of temperature. About two-thirds of the way down the slope is placed an expansion joint to take care of any elongation or contraction. In addition to serving this purpose, the joint is so designed as to support the part of the pipe below it. This is accomplished by means of the water pressure acting against an annular piston attached to the lower section, the piston working in a cylinder attached to the upper section. From the top the pipe runs downward at an angle of about twenty degrees for about two-thirds of its length, where it reaches a level bench about sixty feet wide, and then continues downward at the same slope to the bottom, where it turns with a gentle curve, almost a right angle, and extends underneath the floor of the power house.

POWER HOUSE.

The power house building is a substantial structure of iron and brick, 174 feet by 42 feet, with a galvanized iron roof over matched board sheathing. It is designed to accommodate four complete generating units, and the necessary step-up transformers, switchboards, etc. Only two units and half the capacity in transformers are at present installed. The building is lighted by clusters of incandescent lights, and will be heated by electric heaters. The main supply pipe enters at the end of the building below the floor level, and inside the building widens out into a steel receiver, ten feet in diameter, which is solidly imbedded in concrete underneath the floor. From this receiver four branch pipes come up through the floor, with a quarter turn for delivering water to the branches. In these branch supply pipes are placed the large vertical hydraulic gates, shown in the illustration. These gates are 36 inches in diameter, and are operated by hydraulic pressure by means of a four-way valve, controlled by a lever. These valves will open or close in less than a minute. The gates, as well as all the hydraulic machinery, were supplied by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. Beyond each gate valve is placed a 12-inch spring relief valve, to relieve the pressure when it exceeds that due to the normal static head. The turbines are 1,950 h.p. each, and run at 400 revolutions under the normal head of 280 feet. The water wheels are of the inward flow central discharge reaction type with cylinder gates. We believe that this is the highest head employing this type of turbine, most of the high head plants using the jet or impulse, peripheral bucket design wheels. In order to withstand the unusual pressure, the runners, the gates and all parts susceptible to wear are made of bronze, and everything is made extremely heavy and has been specially designed for this plant. The water enters the wheel horizontally and discharges vertically downward through a draft tube 14 feet in height. Each unit is equipped with a Stillwell-Bierce & Smith-Vaile electric governor of the Giessler design for controlling the speed. On the outer end of the shaft is placed a 7½ ton steel fly-wheel with an outboard bearing. The combined influence of the enlarged receiver, the relief valves and the heavy fly-wheels are calculated to overcome any tendency to water hammer.

The entire electrical equipment was supplied by the Royal Electric Co., of Montreal. The generators are of their well known S.K.C. inductor type, generating two-phase current at 2,000 volts, running at 400 revolutions per minute. Each of the two generators at present installed is of 1,000 k.w. rated capacity. They are connected direct to the turbine shaft by means of an insulated flexible coupling composed of two flanges with projecting pins, the alternate pins being joined by sole leather links. The generators rest on base frames of seasoned Georgia pine to insulate them from the foundations. The stationary armature coils are wound of bare copper strip separated by sheet mica insulation The inductors of these machines weigh over twelve tons, which weight running at such a high speed requires most careful workmanship. The entire absence of vibration and general smoothness of operation is certainly creditable to the manufacturers. The wires connecting the generators to the switchboard are laid in conduits in the floor, which are covered with iron girdles so that they are accessible at any point. There are two exciters of 30 k.w. capacity, each driven by a separate turbine. Each exciter is

calculated for supplying the full equipment of four generators. They are likewise directly connected to and insulated from the turbines.

The main switchboard, as is shown in the engraving, is made up of three white marble panels, one for each generator and one for the exciters. On the generator panels all the connections are made on the back of the board, there being no terminals on the face. The switches are of the S.K.C. slide quick break type, and are provided with automatic shutters to prevent arcing. They are double throw, connecting to two separate sets of bus bars, so that the machines may be run on

THE CATARACT POWER CO.—GENERATING UNITS IN THE POWER HOUSE.

separate lines or in parallel, according to the future requirements of the service. Each generator panel contains a volt meter with a double throw switch connected to both phases, an ampere meter on each phase, and a direct current ampere meter in the filed circuit of the generator. The cases of the instruments are made of ground glass, and present a very attractive appearance. The exciter panel contains the usual instruments for operating two shunt-wound direct current machines in parallel and also contains the synchronizer, which is of the ordinary three lamp type. A special feature is the absence of generator fuses. As the S.K.C. generators supplied were made especially by the Royal Electric Co. to withstand a heavy overload, it was considered safer to risk the strain upon the generators due to a short circuit rather than by the blowing of generator fuses, to cause the instant removal of the entire load from the water wheels.

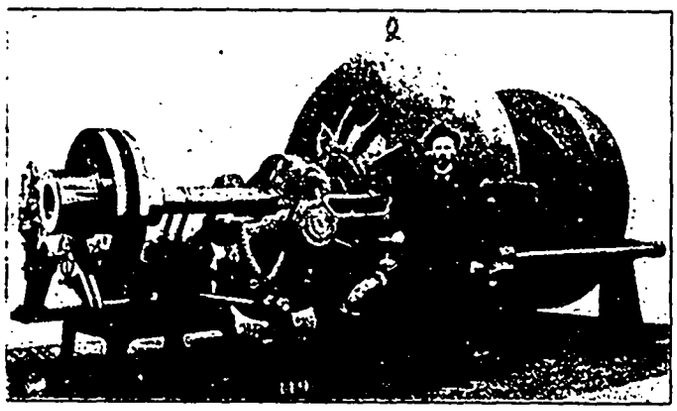
Immediately back of the switchboard and taking up one end of the building are located ten of a new type of S.K.C. transformers used to raise the potential delivered by the generators to 22,500 volts on the transmission line, at which pressure it is now operated. These transformers are arranged in batteries of five; each transformer having a capacity of 200 k.w. They are artificially cooled by means of water pipes supplied direct from the penstock, the pressure being reduced by means of throttle valves. The transformers are encased in tanks made of steel boiler plate, and rest directly on the concrete floor. The coils are wound in sections carefully insulated, and separated by unusually large air spaces, and the whole immersed in mineral seal oil. This construction has been found to admirably answer the purpose of this exceedingly high voltage, each transformer being tested with a break down strain of 40,000 volts before being installed. A novel feature of the installation, is the switchboards which accompany each transformer. They are of specially selected white marble, and contain two single pole high voltage switches, and one double pole 2,000 volt switch, the two high voltage switches being separated by a marble barrier. The high voltage switches consist of a flexible cable, having a screw plug attached to one end and a socket to the other, the socket being attached to a hardwood pole, four feet in length, for safe handling. The socket and the plug which it fits over are tipped with non-arcing metal. By means of these specially constructed switches the 22,500 volt circuit can readily be opened. The low voltage switches are of the S.K.C. slide quick break type on the back of the switchboard. Each transformer is also equipped on both the primary and secondary sides with enclosed non-arcing fuses

The 22,500 volt wires inside the building are all covered with a specially heavy insulation of rubber, and are supported on porcelain line insulators on an overhead rack, all being in plain sight and easily accessible. From the transformers, which are connected five in parallel on each phase, the circuit runs to the line terminal board, consisting of four high voltage switches similar to those placed on the transformer, except that they have double terminals, in order that they may be changed to either of the two lines contemplated by the company. Immediately above the line terminal board is placed a specially constructed lightning arrester equipment composed of 60 S.K.C. non-arcing arresters with their special appurtenances and connections. From the lightning arresters the wires pass upward and out through the wall of the building at a height about 30 feet from the floor.

THE LINE.

The high voltage wires are carried through the brick wall forming the gable end of the power house, by means of lead encased rubber covered cable, protected by vitrified pipe, the cable being kept clear of the pipe by wooden bushings specially prepared in oil. After passing over a crossarm attached to the building, the lead covered cable is joined to the bare copper transmission wires, by means of a long, carefully made waterproof joint. This special construction has proved entirely satisfactory. From the power house the transmission line crosses the Twelve Mile creek, and runs up the hill opposite, on private property, to a concession road, thence along this roadway due north to the Grand Trunk railway, and then westward along the railroad right of way on an almost perfectly straight line to the company's step-down station at Hamilton, a total distance of a little less than 34 miles. The transmission wires are four in number and are No. 1 B. & S. medium drawn bare copper. They are all placed on one four pin crossarm 3¼ feet by 5¾ feet, spaced 18 feet apart, and are supported on porcelain insulators of the Redlands type, supplied by the Imperial Porcelain

Company. The pins are of special design, holding the insulator two inches higher from the crossarm than the standard practice. This is to avoid trouble from heavy snow or sleet.



THE CATARACT POWER CO.—WATER WHEEL UNIT.

The pins are of yellow locust, specially prepared in oil, and are fastened into the crossarm with a wooden pin instead of being nailed, so as to use as little iron as possible. The poles are all specially selected with 8 inch tops and not less than 35 feet in length. They are set 90 feet apart and 6 feet deep in the earth. The height of the poles varies with the contour of the ground, so as to keep the wires as nearly horizontal as possible. In marshy places a crib filled with stone is built around the base of the pole, and where the line crosses the Jordan river, the poles are placed in a cluster of piles specially driven for the purpose. On the top of the poles is run a galvanized iron barb wire grounded at every pole by means of an iron plate for lightning protection Below the transmission crossarm is placed a two-pin crossarm carrying the telephone circuit. The telephone circuit is a complete metallic circuit of No. 10 B.W.G. galvanized wire, transposed at every fifth pole. This arrangement has been found to give satisfactory service with the heaviest currents yet passed over the line. The insulators were all carefully tested with a breakdown pressure of 60,000 volts, both at the factory and again at Hamilton before being put up, with the satisfactory result that not one has broken down, or produced the slightest trouble in the three months during which the line has been in operation, notwithstanding the unusual rain and sleet storms during that period The construction of the pole line was done by Lowe & Farrell, of Hamilton, the Cataract Power Company supplying the material. This work has been executed in a very creditable manner.

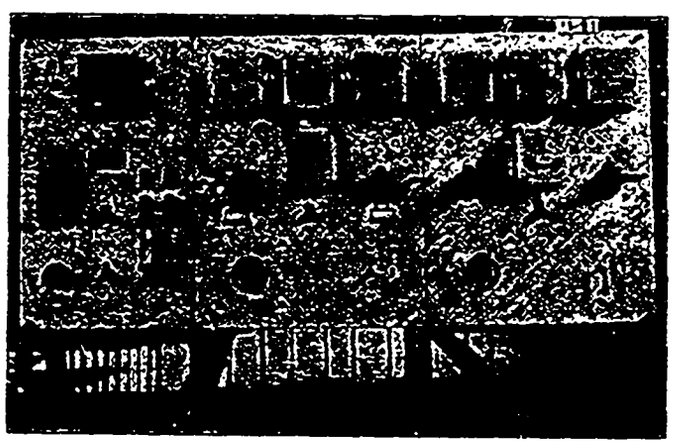
CATARACT POWER CO.—IN-TAKE AT ALLANBURG.

TRANSFORMER SUB-STATION AT HAMILTON.

The company's step-down station is located at Victoria avenue immediately beside the Grand Trunk railway's right of way about one mile within the city limits. It is a neat structure built of brick with a slate roof and specially designed for this purpose. At this point the voltage is reduced to 2,000 volts, at which pressure the current is distributed through the city in four separate circuits. The line wires are carried through the brick walls of the building in the same manner as at the power house. There is the same arrangement of lightning arresters, high voltage lines and two batteries of transformers. The transformers, however, are arranged so as to be artificially cooled at times of heavy load by means of an air blast. The transformers rest over an air duct in the floor, and are provided with a ring of vertical air ducts, passing up through the oil. The blast arrangement, which consists of a No. 6 Sturtevant Blower, direct connected to an S.K.C. two-phase induction motor, delivers air directly into this duct, which then passes upward through the transformers. In the transformer room is also placed the distribution switchboard, and, as at the power house, only half the ultimate capacity of the transformers has been installed, the building being designed to accommodate two more batteries of five, similar to those already placed, consisting of four panels each, containing two ampere meters, two double pole double throw switches, and four duplex fuse blocks. From this distribution switchboard incandescent lighting current is supplied for the Hamilton Electric Light & Power Company, as well as for motors on premises of customers throughout the city. From the switchboard the circuit wires pass upward to a cupola in the roof at which point they are joined to the distribution circuits The line supplying the incandescent service is a four wire two-phase circuit, but the circuits devoted exclusively for power, are composed of three wires only.

At the premises of the Hamilton Electric Light & Power Co. is being installed a new circuit switchboard arranged to accommodate the old single phase lighting circuits of this company. Each circuit is equipped with a double throw switch in order that the load may be divided with a regulating transformer in order that the pressure may be controlled from this point. The old house to house 1,000 volt 16,000 alternation transformers have all been replaced by new S.K.C. 2,000 volt 8,000 alternation transformers in larger units, and the service all changed to this higher pressure in order to reduce the losses and obtain better regulation. In addition to supplying the Hamilton Electric Light & Power Co.'s service, the Cataract Power Company has already contracted for a large amount of power for operating factories of different kinds in the city. They expect within a short time to supply the various electric railways in and about Hamilton, and to replace nearly all the steam engines in the various manufacturing establishments with electric motors.

The plant has been in practical operation for several months, and has thoroughly demonstrated the success of electrical transmission at this high voltage and long distance, which speaks well for the carefulness in designing and construction of the work. The officers of the company are: Hon. J. M. Gibson, president; John Moodie, treasurer; John Patterson, secretary; H. R. Leyden, general manager, the latter having had general charge of all the construction operations.



THE CATARACT POWER CO—GENERATOR SWITCH BOARD.

INAUGURATION.

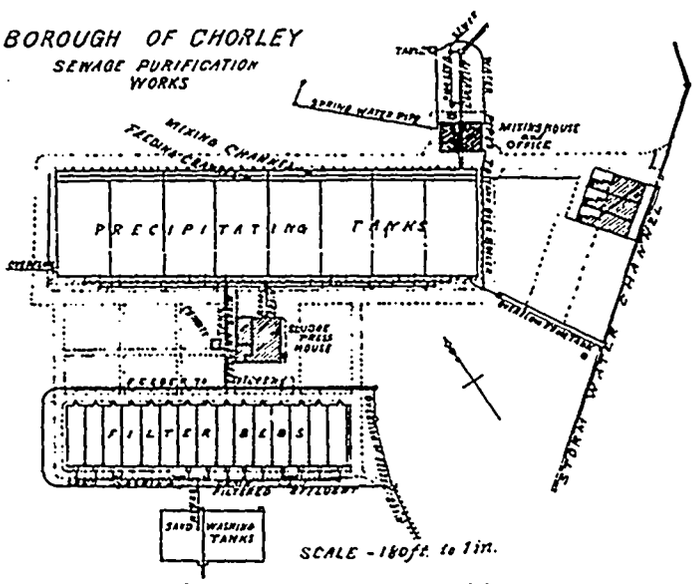
The formal inauguration of the Cataract Power Co., of Hamilton, Ltd., plant at DeCew Falls and Hamilton, Ont., took place on Nov. 12th, when a large company from Toronto, Hamilton and the surrounding towns and cities enjoyed the splendid hospitality of the company. The party left the Grand Trunk station, Hamilton, at 12.30 and went to St. Catharines, from which carriages were provided to DeCew Falls. Among those present were: Hon. J. M. Gibson, president of the Cataract Power Company, Mayor Colquhoun, Ald. Carscallen, M.P.P., A. T. Wood, M.P., T. H. MacPherson, M.P., Adam Brown, J. Turnbull, City Solicitor Mackelcan, John Patterson, John Moodie, Reginald Kennedy, H F. Gardiner, Ald. Metherell, Dr. Osborne, George Tuckett, H. H. Witton, E. B. Wingate, Chester Fearman, Robt. Thomson, A. F. Pirie, of Hamilton; J. J. Wright, E. H. Keating, City Engineer Rust, Assistant City Engineer Fellowes, A. E. Osler, W. H. Maclean, M.P., and others, Toronto.

When the power-house was reached the machinery was found running at full speed, and the whole plant going in marvelously fine shape. The visitors spent an hour in inspecting it. After that a splendid luncheon was partaken of. The chairman, Col. Gibson, proposed the health of the Queen and Parliament. Congratulatory speeches were made by A. T. Wood, T. H. Macpherson, William Gibson (Lincoln), W. F. Maclean and A. F. Pirie. John Moodie and John Patterson also spoke. The train was then taken for Hamilton, where the transforming station was visited. The day was a success from every standpoint both as a successful inauguration of a magnificent plant and as a most enjoyable social event.

THE CHORLEY, ENGLAND, SEWAGE WORKS.

The following is an abstract from the description of the method of sewage purification in use at Chorley, Eng., which was submitted to the Toronto city council by Ald Hallam on his return recently from England: The inlet channel of the sewage from the town leads to a catch basin or pit, the object of which is to catch the detritus, such as road scrapings, sand or gravel and heavy material generally, which will not float, and thus to prevent objectionable materials going into the precipitation tanks, where it would have to be taken out and pressed at much cost. Formerly in case of storm the sand, etc., from the roads washed into the tanks in cart loads. These catch pits are cleaned out about once a week. Some of the storm water comes down here, but most of it goes through the storm water channel, in fact the River Committee of the county council permits, when the flow is three times the normal quantity, to send it direct to the river. This, however, does not often occur, and when it does it is only for a limited period.

The sewage after passing over the catch pit passes through a screen to which is attached a rake or scraper. This scraper is driven by a water wheel, which is worked by a flow of sewage brought to a higher level. The object of the scraper is to keep the bars of the screen free from refuse which has not precipitated when passing over the catch pit, for example, corks, wood, paper, and other floating bodies. From here the sewage flows into the main distributing channel, but before it got there the precipitant (ferrozone), is added in proportion of from 10 to 14 grains per gallon, according to the foulness of the sewage. The quantity of the precipitant is left to the discretion of the man in charge of this part of the works, as it cannot be done automatically. He continually tests the sewage throughout the day, because it varies almost from hour to hour. Comparatively little ferrozone is required during the night time. In addition to the main flow over the catch pit we have a higher level flow, which is brought up under pressure in order to work the water wheel, which is used for two purposes: 1st. For turning the screening arrangement as before stated, and thus saving expense in the generation of steam, and 2nd. For pumping water from a well of spring water, into two large iron cisterns, which are used to supply drinking water to the cottages of the workmen, and also to provide water for the steam engine boiler attached to the steam engine in the press house. If there were a larger flow of sewage and the gradients were right, it would be quite possible to get all the power required from the large water wheel driven by the sewage itself. But the fall in the land sewer is not sufficient. In the mixing room there is an arrangement for mixing the ferrozone with the sewage. The sewage water is diverted from the pipe which turns the water wheel and proceeds underneath the bottom of the tanks, and as it enters these receptacles it takes up particles of ferrozone, making a solution of ferrozone and sewage water, which is mixed by a vertical agitator in each of the tanks, from this the mixed sewage floats into the main distributing channel, which runs the whole length and back again of the eight precipitation tanks. These tanks have a capacity of 140,000 gallons each, the dimen-



CHORLEY SEWAGE DISPOSAL WORKS.

sions will be seen from the plan. Each tank contains from six to seven feet of sewage water. The distribution channel is furnished with both side and baffle plates to assist in the thorough mixing of the ferrozone with the sewage water. In Chorley they are just undergoing a change from the pail to the water carriage system. In the collection of the pails there is spent £1,400 a year, and the contents of the pails are poured into the sewer "en masse." As these pails are only collected weekly, secondary decomposition is set up, and the treatment of the sewage rendered more difficult than would be the case if water carriage were the rule instead of the exception.

It is for this reason that the amount of ferrozone varies from 10 to 14 grains per gallon, if the condition of the sewage was normal, the probability is that 10 grains of ferrozone per gallon would be ample. The mixing channel runs the whole length of the tanks and parallel to them, and leads to the channel which feeds each of the eight tanks. The mixed sewage is allowed to remain in the tanks until such time as in the judgment of the man in charge it is in such a state of precipitation as to be allowed to go into the filters. The time of precipitation varies from two to five hours.

Each of the precipitation tanks is provided with two valves; one for liberating the semi-pure sewage water and the other for liberating the sludge. When as much water as can be drawn from the tanks has been taken, the sludge valve is opened; the man then goes into the tank and removes the sludge at the bottom of the tank towards the valve. There is a fall in the bottom of the tank, and also a fall in the sludge channel to the wall underneath the press house. From this well the sludge is forced up into the press by means of compressed air at a pressure of from 75 to 95 pounds per square inch, water to the extent of 90 per cent of the sludge is extracted by pressing, leaving a sludge cake 35 to 40 per cent water. The valve which liberates the water which then goes to the filters is provided with a floating arm, the use of which is to prevent the floating scum from going into the filters. The purpose of this is to get the water into the filters as pure as possible. When the water leaves the precipitation tanks it is brought down a central channel, and then diverges to the right and left in a distributing channel, which runs parallel to the fifteen filters, which constitute the system.

Each of these filters has a superficial area of 100 square yards. The system in vogue at Chorley is on the intermittent principle, that is, from two to three inches of sewage water only is allowed on the surface of the filter, these two or three inches are allowed to gravitate through the filter, a process

which takes from 30 to 40 minutes, and at the expiration of that time a further flow is put in the filter. The object of the intermittent flow is to provide that the sewage water as it passes through the strata of the filter shall draw air after it. By so doing, the interior of the filter may be said to be purified every time it is used. Each filter has a channel down the centre (on the surface), a perforated wooden trough patented by the chairman of the sewage works committee. The trough is 6x6 inches, and it has three rows of perforations; the object being to equally distribute the water over the surface of the filter without disturbing the top strata (sand), it also helps to oxygenize the sewage water. By this means the water can be placed in the filter at least three times as quickly as when the ordinary iron trough is used. In the latter case the water as it flows from the trough continually stirs up the sand with the effect of mixing the clean and dirty sand together, thereby making the washing of the filters much more expensive. It is contemplated to flush the filters automatically by means of a syphon attachment. The water having passed through the filters, which are arranged in triplets, goes into the river, along an outfall channel, having the appearance, smell and taste of spring water; in fact so pure is effluent, states the report, that a tank has been constructed in which gold fish have now lived for over six months.

The next process is washing the filters. The whole of the filters are washed every week, three per day, the remaining time of washing is used in cleaning the various channels, in fact, one of the great secrets of the success of the works after the construction, must be attributed to the cleanliness of everything about the place. For precipitation works to do their work properly it is absolutely necessary that all channels, except sludge channels, be continually washed out, the filters are washed by means of an upward flow as follows. Two of the filters are filled with effluent from the precipitation tanks, the water filters through each of these and ascends as filtered water into the third, which has to be washed. When the water makes its appearance in the third filter, the washing men, who are provided with waterproof boots, go into it with rakes and brushes and thoroughly agitate and disturb the surface of the sand, which the percolation of the water from the other two filters into the third readily allows them to do, the object of this is to take out an amount of suspended matter which has been left in the filter by the sewage effluent in its progress through the filters. This impurity generally penetrates three inches from the top of the bed, and the work of the filter washers is not complete until the whole of the impurity is comparatively speaking, removed. Whilst this work is going on, the penstock at the bottom of the filter to be washed is opened, in order that the polluted water, the product of the water which has come out of the other filters, and the suspended matter in the sand at the top of the filter under course of washing, may flow through this sand washing water, then proceed down a central channel provided with catch pits to intercept any sand which may be escaping, in order that it may be washed and put back again into the filters into two tanks, whence again it flows by gravitation to a well near to the press house, where it is pumped into the precipitation tank for retreatment; the four inch pipe which conveys the sand washing water goes underneath the filters. The pump has a capacity of 20,000 gallons per hour.

Where lime is used as a precipitant there is a tendency to secondary decomposition. The cost of the precipitant ferrozone is 40s. per ton. Without the intermittent flow it would be absolutely impossible to get the purity of the effluent that is secured at Chorley, the report states; the watershed committee insists upon a certain standard of purity, and it is secured by means of the intermittent system of purification. The cost of the Chorley works is about £18,000. The filters have each 3 feet 1 inch of material. The top strata is composed of fine sand from Fleetwood Harbor. The second of sand and polarite mixed in the proportion of 6 inches polarite and 5 inches sand. The next layer is composed of finest gravel and then follow in rotation pea, bean and walnut gravel, and at the bottom, small boulders.

Population of Chorley, 26,000. The quantity of sewage treated daily varies from 750,000 to 1,000,000 gallons. The crude sewage contains from 3 to 5 per cent. of albuminal ammonia. The purified effluent contains .036 to .075 per 100,000 parts.

MECHANICAL DRAFT FOR STEAM BOILERS.*

BY WALTER D. SNOW.

The first requisites for the successful combustion of fuel are the supply and proper distribution of a sufficient amount of air. To insure the fulfillment of these requirements in steam boiler practice, draft is necessary and the force of the draft must be expended in two ways. First, a portion is necessary to overcome the resistance of the grate and the fuel upon it, of the combustion chamber, flues or tubes and uptake, and of the means of connection to the source of draft, be it fan or chimney. The sum of these resistances is a measure of the pressure head. Second, the draft must, in addition, be sufficient to impart to the air the necessary velocity to furnish the amount requisite for the direct purposes of combustion. This is a measure of the velocity head. With a constant total head any change in the resistances immediately alters the relation between the pressure and velocity heads. Professor Gale found, in the case of a stationary boiler furnace of ordinary construction, that only about 4 per cent. of the total draft pressure was actually expended for the production of velocity, and the movement of the air. Therefore, designs for draft-producing apparatus must first contemplate the creation of sufficient intensity of draft to overcome all resistances, and then provide capacity for the necessary amount of air.

In the case of a chimney, the maximum draft, being dependent upon its height, is constant for the same temperature, and regulation of the combustion can only be secured by throttling the air supply. With a fan, however, the intensity of the draft may be instantly changed from zero to the maximum with a proportional increase in the air volume. Properly, the draft to be determined in practice is that relating solely to the supply of air to, and the overcoming of resistances in, the fire. This is obviously the difference between the over and under grate pressures. Approximately, the volume of air supplied (for equal temperatures) is an index of its velocity and varies directly as the square root of the effective pressure or draft. Conversely, the required draft will vary as the square of the rate. The chimney has long stood as practically the only available means of producing draft, which, thus produced, has commonly been called "natural draft." Primarily introduced for the purpose of increasing the rate of combustion, artificial draft was designated as "forced draft." Artificial draft may be produced by means of steam jets inducing a flow of air, by blowing engines, by air compressors, by positive rotary blowers and by fan blowers or exhausters. The fan has, however, become the accepted symbol of artificial, or mechanical draft, and is to-day the accepted substitute for the chimney.

Two types of fans exist. The first, known as the disc or propeller wheel, is constructed on the order of the screw propeller and moves the air in lines parallel to its axis. It is practically valueless for draft production. The second, or fan blower proper, consists in its simplest form of a number of blades extending radially from the axis, and presenting practically flat surfaces to the air as they revolve. By the action of the wheel the air is drawn in axially at the centre and delivered from the tips of the blades in a tangential direction. This type may be simply designated as the centrifugal, or peripheral discharge fan. The degree of vacuum which may be produced at the inlet, or of pressure which may be maintained at the outlet, of a fan of this type, is dependent upon the circumferential speed of the wheel; and the velocity of the air discharged through an outlet of proper size is substantially equal to that speed. If the fan be allowed to discharge the air through a short and properly shaped outlet, the pressure created will, with an efficient fan, be substantially that required to produce the velocity. The relation between the velocity and the pressure or head is expressed by the well-known formula for falling bodies, namely—

$$V = \sqrt{2gh}$$

in which the head "h" is equal to the pressure divided by the density of the air. From this basis formula it is evident that the pressure created by a given fan varies as the square of its speed. The volume of air delivered is, however, practically proportional to the speed. The work done by a fan is

*Abstract of a lecture delivered before Sibley College, Cornell University.

represented by the distance through which the total pressure is exerted in a given time. It varies as the cube of the velocity; that is, as the cube of the revolutions of the fan.

The ordinary barometric and hygrometric changes in the atmosphere have no appreciable effect upon the pressure and power. But the density varies inversely as the absolute temperature, and, therefore, should enter as a factor even in calculations with reference to air at or about ordinary atmospheric temperatures, and must be taken into account when heated air or gases are handled. In the design of a fan wheel to meet given requirements it is necessary to make its peripheral speed such as to create the desired pressure, and then to so proportion its width as to provide for the required air volume. If possible a fan should never be made so small that it is necessary to run it above the required pressure in order to deliver the necessary volume. To double the volume under such circumstances requires eight times the power; three times the volume demands twenty-seven times the power.

The chimney as a means of creating a movement of air depends upon the heating of that air, by which a difference in density is produced. The heat thus employed is, however, absolutely wasted, so far as its utilization for any other purpose is concerned. This inherent loss with an ordinary coal actually amounts to about 20 per cent. when the gases are at 500°, and the excess of air is 100 per cent. Heat being the agency by which the air movement is brought about, the efficiency of a chimney must be measured by the amount of heat expended for this purpose. As heat is transformable into work, the efficiency is therefore to be measured by the number of foot-pounds of work represented by the pressure difference exerted through the distance moved, as compared with the number of foot pounds represented by the total amount of heat expended.

It may be shown that when no work is lost in friction and the respective temperatures of the external air and the chimney gases are 62° and 500°, the theoretical efficiency of a chimney 100 feet will be only about six ten-thousandths.

If in the place of the chimney there be substituted an engine-driven fan of proper size, the resultant of the efficiencies of the steam boiler, the engine and the fan, together with the loss by friction in the apparatus, may be reasonably taken at about 4 per cent. Therefore, the work done, or its equivalent in heat units expended to produce the given result will be about 70 times as great in the case of a chimney as in that of a fan. All other questions aside, the fan is, therefore, far more economical than the chimney. This economy means that when a fan is employed, the surplus heat can be utilized and the gases reduced to a minimum temperature before they escape.

The methods of application of mechanical draft may be broadly classified under two heads—the plenum and vacuum methods. Under the plenum or "forced" draft method the air may be supplied in either of two ways. First, by making the ashpit practically air tight, and forcing the air into it. Second, by making the fire room itself practically air tight and maintaining therein the required air pressure. Under the vacuum or "induced" method there is practically only one means of application—that by the introduction of an exhausting fan in the place of a chimney. A short and comparatively light stack usually serves to carry these gases sufficiently high to permit of their harmless escape to the atmosphere.

The application of mechanical draft presents a three-fold opportunity for increased economy in steam production; first, in the reduction of avoidable losses, second, in a decrease in the first cost and resultant fixed charges on the entire generating plant, and third, in a reduction of the operating expenses, chief among which is the cost of the fuel. In addition, mechanical draft possesses certain advantages which cannot be directly measured in dollars and cents; such are its peculiar adaptability to the requirements, its independence of climatic conditions, its flexibility and the like.

The losses which are more or less avoidable are: First—Those due to incomplete combustion, as usually evidenced in the presence of smoke and carbonic oxide in the flue gases and in unconsumed coal in the ashes, as well as to a small amount of hydrogen or marsh gas which may pass out with the gases. Second.—Loss from excess of air, due to the fact that to secure practically perfect combustion, air is usually supplied in excess of the theoretical quantity chemically required for combustion. This loss is two-fold, being dependent upon the quantity of unused oxygen and associated nitrogen and upon the moisture in the air. Third.—The loss resulting from too high temperature of the gases leaving the boiler. This loss, except in so far as it is influenced by the air supply and the rate of combustion, is dependent upon the design of the boiler and its appurtenances, and, therefore, is not chargeable to the character of the fuel. It is one of the most important factors in fuel efficiency. Fourth.—Loss of heat by removing ashes at too high a temperature. This, by care, may be reduced but not entirely avoided. Fifth.—Loss by radiation. This may be reduced by increasing the thickness of walls and covering all exposed portions of the boiler. But from a practical standpoint it can never be entirely avoided. The presence of smoke indicates an absolute loss. Although this seldom exceeds 1 per cent. in ordinary practice, even this amount may be almost entirely eliminated and the smoke nuisance may, in most cases, be practically avoided by such regulation of the air supply and the intensity of draft as is possible under the conditions of mechanical draft. The loss of efficiency which ensues from the escape of carbonic oxide unconverted into carbonic acid is due to the much smaller amount of heat given out upon the incomplete combustion of carbon into the former gas. When a fire is suddenly thickened and deadened by additional coal, and large volumes of gas are given off, there is a demand for an increased air supply for the purposes of combustion. At the same time there is a tendency to clog the passages through which the air has previously passed, and thereby to prevent complete combustion at the surface of the fire. At this time, for perfect conditions, more air under greater pressure should be admitted, as is possible under the positive action of mechanical draft. The relative amount of unconsumed coal in the ashes is dependent upon the completeness of combustion and upon the original size of the coal or its tendency to decrepitate as well as upon the size of the free spaces through the grates. It has been conclusively shown that fine fuels can only be successfully burned upon special grates with an intensity of draft such as can be most economically produced by mechanical means.

A most important advantage of mechanical draft is presented in the opportunity which it affords for the proper regulation of the air supply. A certain amount of air is usually necessary for the purposes of dilution, but an unnecessary excess is productive of one of the greatest losses incident to steam generation Theoretically, the amount of air chemically required for the combustion of one pound of coal is about 12 pounds Donkin and Kennedy have shown by gas analyses that, in the case of 16 different plants, the air supply ranged between 56 per cent. and 328 per cent. in excess of the chemical requirements. If the air be supplied in excess of that necessary for perfect combustion, there is a definite loss, disregarding that due to moisture in the air, which is two-fold in its character: First, the excess of air entering the furnace is heated by the burning fuel, thereby lowering the temperature of the mixture of gases and air below that which would prevail if the gases only were present. As a consequence, the rate of absorption of heat by the water is reduced, for it is dependent upon the difference in temperature between the water and the gases. Second, owing to larger volume and higher velocity, there is less time to part with the heat and the temperature of the mixture of gases and air escaping to the chimney is higher than would be the case if there were no excess of air; while the increased volume is such that the total amount of heat thus carried away, without exerting any useful effect, is greatly increased. In other words, paradoxical as it may seem, the larger the volume of air supplied, the higher will be the temperature of the escaping gases.

A high furnace temperature and low stack temperature, other things equal, are evidently conducive to greater efficiency. It has just been shown that such conditions are incident to a reduction in the excess of air supplied. With a decreased supply of air, the intensity of the fire is increased, its temperature is higher, more heat is radiated to the exposed boiler surfaces, and more is taken up by the gases. Furthermore, the diminished superficial area of the grate and of the exposed interstices between the fuel necessitates a higher velocity to secure the admission of a given volume of air. This increased

velocity in turn requires greater draft or air pressure, which may be most readily produced by mechanical means. If a given grate be reduced one-half, and the rate of combustion be doubled, the same volume of air would have to travel through the exposed interstices at twice the velocity. But the pressure or vacuum required to produce this velocity would be four times as great, and, as a consequence, the air would be forced or drawn into spaces between the fuel which it could not reach under lesser impelling force. Much more intimate contact and distribution are the results. Less free oxygen passes through the fuel bed unconsumed, and for a given supply of air a higher efficiency of the fuel is attained. In experiments with a Wilkinson stoker, Witham has shown the most remarkable result of almost perfect evaporative efficiency with a combustion rate of 45.4 pounds and an actual deficiency of 11.2 per cent. in the air supply below the chemical requirements.

Undoubtedly the source of the greatest loss in boiler and fuel efficiency lies in the usual high temperature of the escaping gases. In seventeen independent boiler tests, Donkin and Kennedy found the heat lost up the stack, when no economizer was used, to range between 9.4 per cent. and 31.8 per cent. of the total heat of combustion. With the chimney a comparatively high temperature of the rejected gases is an absolute necessity to the production of the draft. Its production by means of a fan is, on the other hand, independent of the temperature of the gases, and there is, therefore, presented the opportunity to utilize the heat which is a positive and unavoidable loss in the case of a chimney. It is usually customary to abstract the surplus heat from the gases by some means in a sense independent of the boiler, such as a feed-water economizer, or a device for transferring the heat from the gases to the air supplied to the fuel, or both. Roney has shown in the case of nine boiler plants equipped with economizers and mechanical draft, an average fuel saving of nearly 14 per cent. of the total calorific value of the coal. With the Marland type of air heater, Hoadley reduced the total waste in the flue gases to only 5 per cent. of the calorific value of the fuel, and required only 1 per cent. of the total steam generated to operate the blower employed to produce the necessary draft.

(To be continued).

THE MANUFACTURE OF CARBORUNDUM AT NIAGARA FALLS, ONT.

The development of this new industry belongs to Niagara Falls, on both sides of the river. Not very long ago, the first kiln of carborundum ever made in Canada, and the second instance of its manufacture in the whole world, was opened in Niagara Falls, Ont. As yet the extent of its manufacture is not adequate to the number of uses that will create a demand for carborundum, and in a short time it is expected that the output will be very large in view of the rapid growth of its use in all work that requires an abrasive.

The first carborundum furnace consisted of an iron bowl lined with carbon, and a carbon rod; a mixture of clay and carbon was introduced into the bowl, and the rod placed in the mixture. A current sufficient to fuse the mixture, or at least to bring it to a very high temperature, was then passed through the furnace, the iron bowl and carbon rod serving as terminals or electrodes. When the current was cut off and the furnace had cooled down, it was opened, with the result that a few bright blue crystals were found surrounding the carbon rod. The furnaces constructed after this first experiment approached more nearly in form the furnaces in use to-day. They were built of brick, their internal dimensions being ten inches in length, four inches in width, and four inches in depth. The terminals were a pair of carbons, which could be moved longitudinally, thus permitting the distance between them to be altered at pleasure. These were essentially arc furnaces, that is to say, the idea was to form an arc between the terminals and to bring about the necessary chemical changes by the high temperature thus produced. Mr. Acheson, the patentee, soon found, however, that this method of working was not satisfactory, and he then set about constructing the incandescent furnace, which is the kind that is used to-day.

The crude materials for the manufacture of carborundum, viz.: sand, coke, sawdust, and salt, are received in the stock building. These are ready for immediate use. The coke must be reduced to kernels of a certain size to be used as "core," and ground to a fine powder to be used in making the mixture or charge for the furnaces. The furnace room is built to accommodate ten furnaces, though at present there are but five. The furnaces are built of brick, and have the form of an oblong box, the internal dimensions being approximately 12 feet in length, 3 feet in width, and 3 feet in depth. The ends are built up very solidly with a thickness of about 1½ feet. In the centre of either end are the terminals, consisting of 16 carbon rods, 20 inches long and three inches in diameter. The outer ends of the carbons are closed in a square iron frame. Finally, all the space between the inside of the plate and the ends of the carbons is tightly packed with graphite. Each plate is provided with a projection, to which the cables conveying the current may be bolted. These ends are the only permanent parts of the furnace.

The current, as supplied from the Niagara Falls Power Company, has a voltage of 2,200, and to use it in the furnaces it is transformed to a lower voltage.

After the circuit has been closed in the transformer room, no apparent change occurs in the furnace for about half an hour. Then a peculiar odor is perceived, due to escaping gases, and when a lighted match is held near the furnace walls, the gas ignites with a slight explosion. When the current has been on for three or four hours, the side walls and top of the furnace are completely enveloped by blue flame of carbon monoxide. During the run of a single furnace, five and one-half tons of this gas are given off. At the end of four or five hours the top of the furnace begins to subside gradually, fissures form along the surface, from which pour out the yellow vapors of sodium. At the end of about twenty-four hours, the current is cut off from the furnace and it is allowed to cool for a few hours. Then the side walls are taken down and the unchanged mixture raked off the top of the furnace, until the outer crust of amorphous carborundum is reached. This crust is cut through with large steel bars, and can then be easily removed from the inner crust of amorphous carborundum. The inner crust is next removed with a spade, and the crystalline carborundum exposed.

Carborundum is from two to five times dearer than emery, but meets with ready sale, as it is claimed by its makers to do more work and to do it faster and better.

Since Mr. Acheson discovered carborundum, in 1891, there has been other interesting work done on somewhat similar lines, notably that by Professor Henri Moissan, of France, though, as yet, none of it has resulted in the formation of a new industry, like the manufacture of carborundum. However, in the future, we may expect to see other wonderful results obtained from the electric furnace, in which temperatures can be reached that probably do not fall far short of that of the sun itself.

Among the characteristics of carborundum are: Hardness—Diamond is the only material exceeding it in hardness. It cuts emery and corundum with ease. Brittleness—Not as tough as the diamond, closely resembling corundum in this respect. Weight—Its specific gravity is 3.12. It is a little more than one and one-fifth times the weight of sand. One pound of carborundum is equal in volume to one and one-quarter pounds of emery. Infusibility—Infusible at the highest attainable heat. Decomposition occurs in the electric arc. Insolubility—It is insoluble in any of the ordinary solvents. Water, oils, and acids, have no effect upon it, not even hydrofluoric acid, which readily dissolves sand. Chemical Composition—It is composed of carbon and silicon in equal atomic proportions, and by weight, thirty parts carbon to seventy parts silicon. Its chemical formula is SiC. Color—Pure carborundum is white. In the commercial manufacture the crystals are produced in many colors and shades, partly as the result of impurities, and partly owing to surface oxidation. The prevailing colors are green, black and blue. The color has no effect upon its hardness.

The Carborundum Co. has made arrangements with the Hart-Emery Wheel Co., Ltd., Hamilton, Ont., to supply it with carborundum grains and powders, from which it will manufacture wheels, rub-stones, sharpening-stones, etc., and the Canadian trade will be fully supplied with these goods in the same qualities as are placed upon the United States market.

TORONTO CITY ENGINEER'S REPORT FOR 1897.

The annual report, published by the city engineer's department, of Toronto, has just been issued for 1897. The works of the year have been carried on under the direction of E. H. Keating, C.E., who was city engineer for nearly six years, and was succeeded by C. H. Rust, C.E., in February of the present year. From the report we learn that there were 0.46 miles of asphalt pavements laid in 1897, as against 0.366 miles in 1896, and 1.156 in 1895. In macadam, 0.510 miles were laid in 1897, 1.661 in 1896, and 1.663 in 1895. Gravel roads were laid in 1897 to the amount of 3.138 miles. None were laid in 1896 or 1895. Brick on concrete, 5.803 miles for 1897, as against 1.032 miles for 1896, and 0.744 miles for 1895. The unpaved roads in 1897 covered 78.45 miles. In 1896 they covered 79.74 miles. The total mileage for the year is 258.3, against 257.4 for 1896, 256.4 for 1895, and 253.4 for 1894. The different classes of pavements now laid in the city are as follows:

	Per Cent.
Cedar block	39.24
Stone and scoria	0.31
Asphalt	5.84
Brick	1.37
Wood and concrete	0.21
Macadam	15.68
Gravel	1.25
Cedar blocks with asphalt between tracks	2.10
Cedar blocks with brick between tracks	3.21
Macadam with stone setts between tracks	0.42
Unpaved	30.37

The waterworks consumed 10,355½ tons of coal, pumping 6,723,757,030 gallons of water. The Waterworks Department laid 503 services during the year. At the end of the year there were 2,982 hydrants in use. There were 1,556 meters of all kinds in use in the waterworks branch, of which 936 were Crown, 341 Worthington, and 231 Siemens & Adamson. There were 54 new meters put in during the year. In street sprinkling, the distance traversed by the three trolley tanks was 18,591 miles, the quantity of water discharged in the process of sprinkling amounted to 23,895,700 gallons, representing 8,893 loads. The quantity of water consumed in the ordinary watering service (wagons), was 37,045,375 gallons, or 75,296 loads, making a total for the season of 60,941,075 gallons, sprinkled on the streets.

THE CONSTRUCTION OF GARBAGE DESTRUCTORS.

BY FRANK LESLIE WATSON, ASSOC. M. INST. C.E.*

In the design and construction of a successful and economical refuse destructor plant, the following are the principal points which must be borne in mind:

A. It must never be forgotten that the primary object of a refuse destructor is, as its name implies, to destroy refuse, and to destroy that refuse as completely as possible, and without the production of any description of nuisance. By the term to destroy refuse in this connection is implied a practically absolute chemical separation of the combustible portions of the refuse (such as the carbon, phosphates and nitrates, which are found in cinders and in animal and vegetable matter), from the non-combustible portions (which are chiefly mineral), and includes the complete oxidation of the former class, and the fusion and agglomeration so far as is possible into hard clinker of the latter parts. It must be regretfully admitted that in a very large number of destructors, these important objects are only attained to a very limited extent.

In order to insure a perfect result:

(1) A high temperature must be attained; 1,300 deg. Fahr., is admissible, but 1,600 deg. to 1,800 deg. Fahr. is better. It is not sufficient to impart the desired temperature to the furnace gases after they leave the furnaces. Such devices as Mr. Jones' patent fume cremator (intended for this purpose), have done good service in their day in preventing the abominable emanations from the chimneys of old-fashioned low-temperature destructors; but at the best, such a device as a fume cremator is only useful in securing perfect oxidation of the gases and vapors distilled from the refuse, while giving no assistance whatever towards completing the other and equally necessary part of the process—namely, the reduction to innocuous clinker of the solid refuse itself. For this purpose it is essential that a high temperature must be kept up in the furnace itself, as well as in the flue.

(2) Having provided means for securing a high temperature in the furnaces and the flues, such arrangements must be made as will secure that the whole of the refuse and the whole of the products of combustion or distillation must be subjected to this high temperature, in presence of sufficient air, and for a sufficient length of time to insure complete oxidation of all combustible substances.

(3) It is also necessary that the products of combustion passing up the chimney must be as free as possible from solid matter, such as dust, which, although they may be so perfectly burnt as to be free from any taint of putrefaction, yet their mechanical effect upon the leaves of trees and plants, upon the lungs of persons and animals, and upon clothing and furniture, are such as to become an intolerable nuisance, and a nuisance which has been proved in more than one instance to be actionable at law.

B. The destructor must be so designed as to involve the least possible expense in its working. To this end the handling of the refuse should be reduced as much as possible, though it must be borne in mind that the adoption of cumbrous and complicated mechanical feeding arrangements has hitherto been found to give no relief in the matter of labor; in fact, it has even involved additional labor, while at the same time such machinery is frequently very costly, both in construction and in upkeep and working charges. It must always be borne in mind that machinery working in the presence of large quantities of dusty and dirty material deteriorates very rapidly, and any machinery which is required about a destructor, particularly electrical machinery, must be so arranged as to be as nearly as possible boxed in and protected from dust. The author would mention, as an instance, the Shoreditch combined electrical lighting and destructor plant, where, according to the abstract of accounts, published in The Electrical Review, of May 27th, 1898, a large proportion of the total current produced appears to have been used on the works in driving fans, lifting machinery, etc. The author believes that this excessive expenditure of energy is due in a large measure to the extra resistance caused by the impossibility of keeping switches, brushes, etc., in proper order in presence of dust and dirt. In order to ensure economy, the safest points to bear in mind are that the refuse should be brought in the collecting carts, as near as possible to the charging holes of the furnaces, and the tipping arrangements should be such that a minimum of work is involved in properly charging the furnaces. It must also be remembered that considerable judgment is required in working a fire, and that judgment is not usually a faculty possessed by machinery. In order to obviate any difficulty in separating clinker from unburnt matter, and in order to insure as nearly as possible a continuous process in the furnaces, they should be fed at one end of the grate, and clinkered at the other, and the arrangements at the clinkering end should again be such as to involve the least possible labor in removing the clinker and to avoid altogether the necessity for breaking it up in order to get it through small openings.

C. In these days, people are not content with getting rid of the refuse in an inoffensive manner. It has been demonstrated that large quantities of heat are available from the combustion of refuse; and, therefore, it has become necessary that this heat should be utilized, and at present almost the only practicable method of utilizing the heat is in the evaporation of water. When it has been shown that in practical use eight tons of refuse will raise as much steam as one ton of good coal burnt under good conditions, and that it will raise that steam to the highest working pressures ordinarily adopted, there can be no doubt as to the advisability of providing sufficient boiler-room, and arranging a suitable use for the available power. In order to secure the best results, the boilers must be placed near enough to the cells to prevent any important loss of heat by radiation, but they must not be placed near enough to interfere with perfect combustion of

*A paper read in the Engineering and Building Construction Section of the Congress of the Royal Institute of Public Health recently held at Dublin.

the gases, which is generally not completed until after they have left the furnaces and traversed a certain length of flue to insure proper mixing. It must be borne in mind that, even in boiler firing, with coal, any contact of the gases with comparatively cool cross tubes, etc., before they are perfectly oxidized, will check the combustion, and cause smoke, and it is obviously useless to mix any further oxygen with such unburnt gases after they have dropped below their natural temperature of combustion or "flashing point." It may here be mentioned that water-tube boilers are the most readily adapted to the requirements of a destructor station, although very good results have been obtained with other types, particularly Lancashire boilers. The comparative safety of water-tube boilers from explosion, and their general handiness and convenience, render them particularly adapted for working where the labor employed is not of a highly cultivated order, and generally in connection with these plants it is best to remember that, whatever apparatus is provided, it will probably have to be worked by stokers.

D. The solid matters resulting from the combustion of the refuse—e.g., clinkers from off the grates and fine ashes from underneath them—must be made use of for two reasons. first, if they are not made use of, they must be carted away and tipped to waste at a further cost. Second, they may be made a valuable source of revenue. It must not be forgotten that we have here another powerful argument in favor of high temperature destructors, the clinker from which will be completely fused, and will contain no combustible or putrescible matter, and will therefore be of a hard and sharp nature, in contra-distinction to the clinker from low temperature destructors, which is soft, friable and totally useless, and frequently even putrescible. It is no uncommon thing for such half-burnt clinker to take fire again, after being tipped into a heap, and thus to occasion serious nuisance. Assuming, however, that the clinker is going to be of a hard and useful character, we shall require machines for breaking it up, grinding it, and mixing it with lime, etc., to form mortar, and these machines must be powerful, massive and durable. Having thus briefly sketched the requirements of a destructor plant, the author will proceed to give some details of the manner in which these objects have been attained in one or two plants in the design and construction of which he has been concerned.

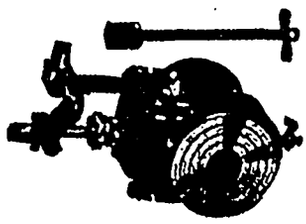
(To be continued).

STRAIGHTWAY QUICK OPENING VALVES.

It has been demonstrated by practical boiler users, the makers of this valve state, that the most satisfactory way of arranging the blow-off is to use two cocks—one to open and close and take the wear and tear, and the second cock to make a perfect stop; but even with this arrangement it is necessary to blow down and remove the cocks to make repairs. With the duplex valve all these objections are overcome. The engineer can make the necessary repairs without blowing the boiler pressure down or removing the valve, as he has perfect control over it at all times, and can make repairs or renew the discs during working hours, with the pressure on, thus avoiding breaking joints or using a leaky blow-off, and saving night, Sunday, or holiday work.

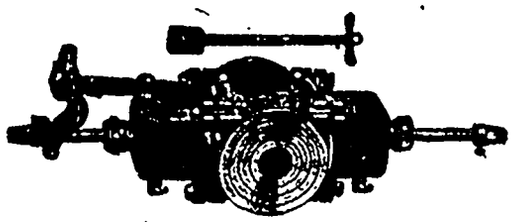
SECTIONAL VIEW.

The object to be attained by this device is to provide an easily operated and durable valve. There is contained within the valve a sliding cage, in which the discs and port are arranged. The valve stem connects with the cage, and a sliding motion is imparted to the cage and valve stem by a forked lever, which is pivoted to the valve body, and has suitable stops to arrest the movement of the cage at the proper place to bring the discs or port in the cage opposite the ports in the valve body When the ports of the valve are in line with the ports of the cage, the cage covers the seats of the valve and protects them from wear by scale and grit, when blowing off the boiler With the cage in this position, the ports form a straight cylindrical passage through the valve, without any obstruction to the current while passing through,



JENNING'S SINGLE BLOW-OFF VALVE.

To close the valve, move the cage so the discs are placed opposite the valve ports, then they are expanded out against the valve seats by rotating the valve stem, which has a taper nut that engages with both discs, to expand or contract them.



JENNING'S DUPLEX BLOW-OFF VALVE.

To open the valve, the valve stem is rotated in the opposite direction to contract the discs, releasing the cage and allowing it to move with ease. The discs should be run all the way back to be sure that they don't drag over the faces of the valve seats and scar them, which will cause a leak. The valve stem is rotated by a special socket lever wrench, which engages with a hub on the ends of the valve stems. To throw the cage from point to point, the socket lever is placed on the hub (which is cast on the end of the forked lever), so as to make an extension and give greater leverage to operate the valve. These valves are placed on the Canadian market by Garth & Co., Craig street, Montreal.

ELECTROLYSIS IN GAS AND WATER PIPES.

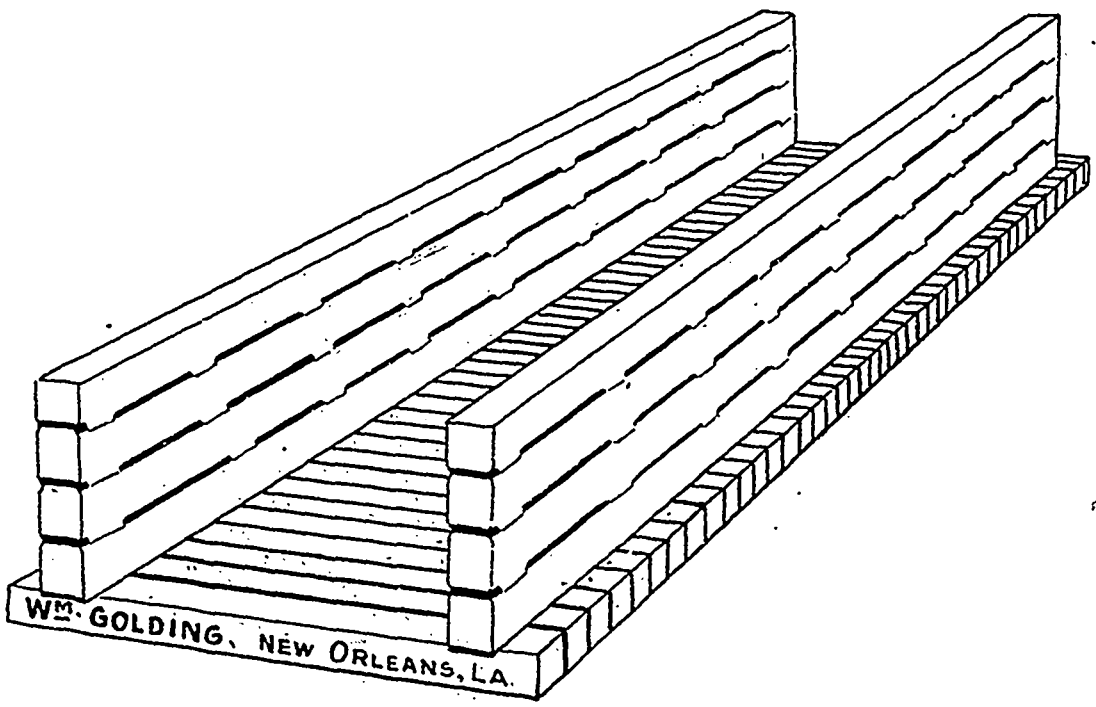
The electrolytic effects of the currents leaking from street car rails to the metallic pipes near them formed the subject-matter of two papers recently read before the American Institution of Electrical Engineers. The first was by A. A. Knudson, entitled "An Electrical Survey in the Borough of Manhattan, New York," and the other was on the "Electrolysis of Cast-Iron Water Pipes at Dayton, Ohio," by Harold P. Brown. In both cases great damage was proved to have been done. It appears from the tests made by Mr. Knudson that an open-conduit system, or one in which an insulated metallic return is used, effectually confines the current to the conductors provided for it. H. P. Brown, in conclusion, offers the following comments and practical suggestions on the matters generally to water and gas engineers: Do not imagine because your pipes are not leaking and bursting that they are safe from electrolysis. If the electrical conditions are against them, they are getting weaker day by day. Do not antagonize the railways the moment that the subject of electrolysis comes up. The best course for all concerned is to take mutual action. Do not put down any more lead or wrought-iron service pipes, as these are the first victims of electrolysis, and their replacement means ruin to pavements. Use instead wooden pipe, banded with a close spiral of hoop iron and covered heavily with asphaltum. This will stand the heaviest pressure in use, and is not affected by electrolysis, since the hoop iron is low in conductivity, and is not electrically connected at the joints. Its cost is said to be reasonable, and it has a successful record of many years' service. Use the same kind of pipe for new mains in any district in which a railway power-house is likely to be erected, and heavily paint the lead caulking of cast-iron mains, using asphalt or petroleum wax. In the danger district along the lines of electric roads, and on intersecting streets, put into your water and gas mains two or more consecutive lengths of these wooden pipes so as to break the electrical continuity of the mains, and thus make their resistance greater than that of the rails. Fill in the space around them with broken stone, and connect with drain if possible. Midway between the wooden sections on each main attach insulated pilot wires leading to a central office. Connect similar wires to the rails nearest the pipe wires and

make daily electrical tests at times of heavy load. If any section shows positive to the rails cut it at once into smaller sections, and call upon the railway to rebond its line upon that street. This, with the proper electrical management of the railway feeder wires and apparatus, will effectively protect your mains.

A FLOATING DRY DOCK.

Editor CANADIAN ENGINEER.

The annexed sketch illustrates a floating dry dock, designed by me several years ago, the feature of which consists of assembling a number of steel pontoons, aggregating sufficient lifting capacity, and in securing same in such manner as to form a solid structure, and yet permitting the removal of each pontoon for painting and repairs.



For a dock of this type, capable of lifting twelve thousand tons, the length will be five hundred feet, and the inside width eighty feet. There will be forty pontoons, placed side by side, yet two and one-half feet apart, each ten feet wide by twelve feet deep, and one hundred and twenty feet long. There will be eight submerging tanks, constructed precisely the same as the pontoons, which will be placed one upon the other as shown, yet being separated by I bars to facilitate painting. These tanks will be five hundred feet long by ten feet square, each. When the pontoons and submerging tanks are placed in the position shown in the sketch, they will be secured by suitable stirrups, which will pass entirely around each pontoon, and extend to the top submerging tank, thus securing and combining the pontoons and submerging tanks as one structure. The pontoons will be divided into three compartments, each forty feet long. To sink the dock, water will be admitted into the two end compartments, the centre compartments being barely sufficient in the aggregate to balance the entire weight of the dock. When the pontoons are filled, water will gradually flow into the submerging tank through suitable controlling valves, which will be closed when the required depth is reached. For removing the water from the pontoons, there will be placed on the outside ends of same eighty pumps of proper type and size. These pumps will be operated in four sets of twenty each on one shaft, at each quarter of the dock. The motive power will be electricity, supplied from a power-house conveniently located on land. No water will be admitted to either of the top tanks, in which there will be sufficient reserve to float the entire dock, even should all valves be left open. The objects sought to be gained in this type of dock construction are economy of construction, simplicity in operation, facility of preservation, and absolute safety. Total weight of material is 6,000 tons; net lifting capacity is 12,000 tons; gross lifting capacity is 18,000 tons. It is estimated that a dock of this type and capacity can be constructed and set up, ready for operating, for the sum of $400,000.

WM. GOLDING.

New Orleans, La.

HIGH LEVEL PUMPING STATION, ST. JOHN, N.B.

The following description of the new high level pumping-station in St. John, N.B., is taken from the annual report of the waterworks department, made by the engineer in charge, W. Murdoch, C.E.

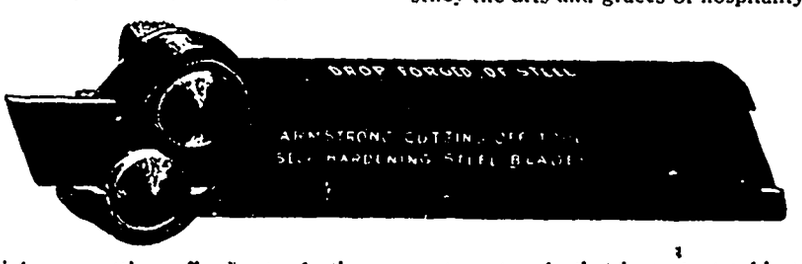
Under an order passed by the Common Council on July 15th, the work of preparation for the new pumping station at Silver Falls was commenced on August 2nd, by a party of men being sent in to clear the land. It is traversed by Little River for a distance of 475 feet, and comprises the two upper successive porches of Silver Falls, which are 275 feet apart. The lower one of these falls, which is but 140 feet distant from No. 3 leading main, drops into a pool whose surface is sixty feet below the level of the head of the upper fall. The minimum flow observed here at the dryest time was 135 cubic feet per minute. The maximum has not been gauged, as it is often a raging torrent. A stone dam, sixty-five feet in length, and varying up to eleven feet in height, has been built on the upper fall, and a cast-iron flume extended therefrom to the crest of the lower fall. This flume is 24 inches in diameter for a distance of 200 feet, and reduced to 15-inch and 12-inch pipe the remainder of the way. The large pipe was old stock left over from the laying of No. 3 main, 25 years ago, when it was charged to that main.

A frame building is placed at the lower fall, the floor being ten feet above the pool already named. This is for the turbines, and through it the twelve-inch flume will extend to supply the turbines and terminate with a gate valve of the full size, discharging into the river. The two turbines were made by J. C. Wilson & Co., Glenora, Ontario. They are eight-inch horizontal double turbines, with draft tubes, and can be worked either at half gate, when each will develop twelve h.p., or at full gate, when double that power is to be realized. This will enable the obtaining of the full efficiency of a wheel, when only enough water flows to give twelve horse-power, and in an emergency, if such emergency occurs when there is water enough in the river, 48 horse-power can be had. But the main object in having two wheels is to hold one in reserve while the other is in use, so that there be no stoppage in the auxiliary service when once begun. Another precaution against stoppage is that in the rope transmission between the turbines and the pumps, four independent ropes are to be used, each with its own tightener, the whole to be

enclosed in a shed reaching up the slope (which rises at an angle of 39 degrees), to pump-house. The pump is being built by the Northey Manufacturing Company, of Toronto. It is specified to be a double-acting power pump with a capacity of 33 imperial gallons per revolution of the crank shaft. A brick building, 10 x 20 feet eight inches, has been built for its reception, at a distance of 15 feet south of the pipe line. As soon as the weather permits, after the arrival of the pump, the main pipe will be cut and a branch led therefrom to the suction of the pump. From the delivery another pipe will return to the main, and between these two branches will be placed a check valve with balanced gate, set in such a way that when the pump is in operation, the valve will close, and the water be driven onward to the city, but should the pump stop, the valve will open and allow the water to gravitate as it does at present, delivering only into the basements of the highest houses.

THE ARMSTRONG CUTTING OFF TOOL.

The Armstrong cutting off tool (patent applied for), is made in seven sizes and is especially adapted for the economical use of self-hardening steel. The latest addition to the Armstrong tools is the cutting off tool, illustrated herewith. This



tool will cut off and keep right on cutting off. It stands the racket of constant work, and this is one of the chief points of difference, its makers state, between Armstrong tool holders and imitations of their tools. The holder and bolts are made of steel and hardened. The cutters are made of special grade self-hardening steel, rolled beveled on both sides, giving the proper clearance to ensure a clean cutting tool. The blade requires grinding on the cutting end only. Aikenhead Hardware Co., Toronto, is the Canadian selling agent.

JOHN GALT, C.E.

John Galt, C.E., who was appointed city engineer of Ottawa, Ont., Nov. 14th, and entered upon his new duties Dec. 1st, was born at Kilmaurs, Ayreshire, Scotland, Sept. 23rd, 1852. Although he is comparatively young, his experience as an engineer has been varied and thorough. It has included the construction of railways, canals, waterworks, drainage systems and public improvements of all kinds. Mr. Galt was educated at the Kilmarnock Academy, and, after obtaining a Government science scholarship, he took a full university course, and graduated in engineering at the universities of Glasgow and London. For a time he followed his profession in Glasgow, being engaged in some of the large railway improvement schemes, and was also superintendent and lecturer in the Government science schools in Glasgow for several years. In 1878 he went to the United States, where he was engaged in railway engineering on the Southern lines for three years. Upon coming to Canada in 1881, he wae appointed general manager of the Boiler Inspection and Insurance Company of Canada, retaining this position for four years. Since 1885 he has been engaged as a consulting engineer, and has been very fully employed during that time chiefly upon municipal work.

TRADE IN THE YUKON.

The principal traders in the Yukon, writes a correspondent of THE CANADIAN ENGINEER, are. The N.A. Trading Co., and the Alaska Commercial Co. These are the two great trading companies, who up to the past season have had almost a monopoly of the local supply trade. They are United States companies, but none the less to be cultivated, as already they are purchasers of Canadian goods. Your letter suggests two very great lacks in our trade circles to-day. One is the fact that our merchants have not yet appreciated the advantage to Canadian trade of the Dawson or local demands. Another is in the reminder of the character of Klondike trade. The average person is half inclined to doubt that Dawson has any demands for textiles, etc. There is a surprise in store for our wholesale merchants in the character of the supplies needed at Dawson, especially this year. People for many months in the year, at least, dress there as here, except that the social laws are less exacting. In the coming time, however, there will be a growing demand for all the luxuries of metropolitan life, and there is a field open in meeting this demand. But the change will come, and we ought to take due advantage of it. With next year will come closer and quicker connection with that country, and following cheaper transportation will be increased demand.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

TWELFTH ANNUAL BANQUET OF TORONTO NO. 1.

The twelfth annual banquet of C.A.S.E., Toronto No. 1, was held at the Walker House, Toronto, on Nov. 23rd, the president, Chas. Moseley, in the chair. The very efficient committee in charge of the banquet arrangements were: A. M. Wickens, Albert Slute, J. G. Bain, J. Banman, W. C. Tait, J. Marr, chairman; Geo. Thompson, secretary, and Geo. Mooring treasurer. How thoroughly the committee had performed their duties was augured by the large number of members and their friends and guests who assembled a little before 9 o'clock in the corridors of the Walker House, where smiles and jests and pleasant greetings alike to old friends and new acquaintances showed that the stationary engineers need not at least study the arts and graces of hospitality, as they were one and all past masters in that important subject already. The good work of the committee was in evidence throughout the evening, which passed without a single flaw, from the entry of the crowd of nearly two hundred into the spacious dining room, through the well served dinner and the subsequent speech-making and music till the last good-night had been said. The menu was as follows: Spanish olives, celery. Soup—Tomato, aux Croutons. Fish—Boiled Columbia river salmon, Hollandaise sauce, Pommes de terre, a la Parisienne. Entrees—Chicken croquettes, a la Richelieu, escalloped oysters, a la Baltimore. Boiled—Leg of Southdown mutton, caper sauce. Roast—Ribs of beef, with horse radish, young turkey, cranberry sauce. Vegetables—Mashed potatoes, green peas, sugar corn. Game—Haunch of venison, with jelly. Pastry—English plum pudding, brandy sauce; apple pie, lemon meringue pie, raspberry tart, assorted cakes, wine jelly, rock punch. Dessert—Blue-basket raisins, apples, oranges, bananas, filberts, almonds, Malaga grapes, MacLaren's imperial cheese, gorgonzola cheese, tea and coffee.

Before the toast list was reached the assembly had the pleasure of listening to a piano solo by Mr. Fisher, and then the president, Chas. Moseley, in a short speech welcomed the members and their guests to the twelfth annual banquet. After expressing his pleasure at the large attendance Mr. Moseley referred to the growth of the order, and its most satisfactory condition, not only as regards Toronto No. 1, but the other branches as well. The chairman then proposed the toast "The Queen," which was drunk with an enthusiasm which amply demonstrated the loyalty of the engineers of Toronto. W. G. Blackgrove then sang "Soldiers of the Queen," with fine effect, his rich voice stirring the audience to a fresh outburst of patriotic cheers. As an encore Mr. Blackgrove sang "Out on the Deep." The names of Mayor Shaw and Ald. F. Woods were coupled with the toast "Toronto, Our City," The mayor in responding spoke of the present prosperity which is prevailing in Toronto in contrast to the years of depression just passed through. He believed the present expansion would be permanent, and instanced the growth of several of our city's industries, and the entrance into the city of firms formerly doing business outside. He promised that efforts would be made to gain for Toronto some of the general benefit resulting to the country from the enlargement of the St. Lawrence canals. The mayor expressed his sympathy with the efforts of the committee on legislation to secure official recognition of the Examining Board of the Society. Ald. F. Woods confined his speech to an appeal for support in the approaching municipal elections on

the score of his being a member of the Typographical Union, and the work he was doing to advance its interests in the city council. The toast of "Canada, Our Country," was proposed amid cheers, and the singing of patriotic songs by Messrs. Fox and Grant, the toast was coupled with the names of Geo. Anderson, manager of the Royal Oil Co., and A. M. Wickens. Mr. Anderson spoke of the growing prosperity of Canada and congratulated the association on the fact that its name of "Canadian" was so truly an indication of the spirit of loyalty in the society. He rejoiced in the fact that Canada is now in closer relations with Great Britain, and is now admitted to the councils of the nation. He pointed out that there was great room for development in the science of mechanics, and that there was therefore room for engineers not only to inform themselves as to what is already discovered, but to make original investigations. A. M. Wickens was proud of his Canadianism, and of his allegiance to "Our Lady of the Sunshine." He referred to the progress of the Technical school, and the good influence of the association in helping it along. The toast of the "Manufacturers," was responded to by C. L. Weeks of the General Engineering Co., J. M. Sinclair, manager Eureka Mineral Wool Co., and Jas. McLaughlin, of the Queen City Oil Co. Mr. Weeks spoke of the keenness of competition in business at the present, and the necessity of taking advantage of all aids to increase production. Mr. Sinclair made a brief speech congratulating the association upon its growth and progress, and upon the good times in the country at large, which permitted in very many industries the employment of day and night shifts. Mr. McLaughlin made what was quite one of the best speeches of the evening, in which he spoke of the fact that manufacturing and trade had been the source from which freedom had come into the state in the old days. He spoke of the unrivalled facilities which Canada offers to the manufacturer in every department of trade in her wonderful natural resources. Formerly Canadian products had to be sold as from the United States, now in many lines the name Canadian adds to the price. Mr. McLaughlin in closing referred to the great progress the oil industry was making in Canada, as witnessed by the building at Sarnia of one of the most complete refining plants on the continent in the past year. "Educational Interests" was responded to by J. Galbraith, principal of the School of Practical Science, Toronto, and A. G. Horwood, secretary of the Toronto Technical school. Mr. Galbraith spoke of the growth of the school over which he presides, and stated that he believed that the science of mechanics as applied to the steam engine was very near its final development, and that little further in this department should be looked for. Mr. Horwood asked the aid of the members of the association in advancing the interests of the Technical school. Bert. Harvey here sang a most laughable and clever medley, and as an encore, "I Want to Join the Army." The toast of the Executive Council was responded to by E. J. Philip, G. C. Mooring, R. C. Pettigrew and A. E. Edkins, who each made a few appropriate remarks. "Sister Societies," was responded to by J. Dixon, Toronto No. 18, and R. Mackie, president of the Hamilton branch of the association, and J. R. Nuttley, Waterloo, who all expressed pleasure in the growth and prosperity of Toronto No. 1. The "Press" was responded to by the representatives of The Electrical News and The Canadian Engineer. A feature of the evening much appreciated by the gathering was the comic singing of J. Fax, whose efforts were received uniformly with tremendous applause. The following were present: A. E. Edkins, A. G. Horwood, R. C. Pettigrew, Ald. F. H. Wood, Mayor Shaw, Chas. Mosley, G. C. Mooring, Chas. Rust, C.E., Geo. Anderson, Prof. Galbraith, Alex. Fraser, John Dixon, A. Lang, Geo. May, Jas. McLaughlin, W. McGee, J. M. Dignum, W. Sherman, A. Doyle, J. Queen, G. W. Gore, W. Sutton, Geo. Bradley, D. McBain, F. Auchlincloss, Chas. Smith, R. Gondy, T. H. Dryden, Sam Thompson, A. Boyce, James Fax, W. Black, W. Keating, A. R. Taylor, E. Terry, F. Barton, Bert Harvey, J. Edward Fisher, J. G. Bain, W. C. Tait, Jos. Bell, W. Bourne, G. Evans, H. Butcher, J. Grout, Fred. Kirk, F. H. Fulshell, R. Galt, A. Richardson, R. Mercy, Joseph Hughes, G. Clatington, Wilson Phillips, M. B. Tullman, John Gourley, Angus McMaster, W. Dawson, D. Hunt, J. H. Pringle, Sam B. Mills, A. J. Woodward, W. Stevens, T. Hope, Geo. Mackie, Robert Mackie, J. Ironsides, Jas. Bannan, Albert Slute, E. J. Philip, C. L. Weeks, Jas. Sitster, J. Ennicht, W. McLean, J. Carson, A. H. Granger, John Emms, Jas. Mooring, W. Pierson, G. Graham, J. Barrow, J. Everett, A. Backer, F. Day, J. Day, J. McLeary, A. Travin, F. Barrett, B. Hallen, W. Truckman, E. Ireland, R. Davies, D. McEvoy, A. W Smith, J. Spencer, J. Prestege, R. Johnston, R. Broughall, E. Dudgeon, S. Graham, J. Fensom, W. Mashint[illegible], S. McKay, G. W. Grand, J. Fisher, H. W. Sayton, G. Thompson, W. Mooring, J. Nicholson, J. Granger, A. J. McDonough, E. Ash, W. E. Archer, W. J. Webb, J. S. Anderson, J. Huggett, A. T. Robb, T. Eversfield, E. G. Fowler, G. B. Cowers, J. R. Nuttley, J. C. Long, J. M. Sinclair, W. L. Outhwaite, C. Scott, A. Scott, F. Vantown, T. Hodgson, J. Bannan, M. Burns, J. Fox, W. S. Butler, S. Butler, J. R. Bennett, W. G. Hamner, S. Woodhouse, B. Campbell.

WIND PRESSURE, ACTUAL AND ESTIMATED.

Editor CANADIAN ENGINEER.

In a recent issue of the Scientific American, in an editorial on Sir T. W. Barry's remarks, at the meeting of the British Association at Bristol, anent the want of agreement between the results and conclusions of experiments on a small scale, and the working of nature on a more extensive basis, there is an allusion to the fact, among others, that as far as wind pressures are concerned, and while at the Forth bridge in Scotland, 58 lbs. to the square ft. were allowed for, based on the indications of ordinary anemometers, the result of an experiment on a 300 ft. surface, under like conditions, showed a falling off of very nearly 40 per cent. Again, at the "Tower bridge," London, while conclusions, based on anemometrical readings, indicated a pressure of 6 to 9 lbs. per square ft., experiments conducted on the bascules of the bridge, whose area is 5,000 ft., showed only from 1 to 1½lbs. wind pressure, under absolutely similar conditions. These glaring differences are accounted for on the assumption that a gale of wind presents areas of maximum pressure, which are far in excess of the average pressure. Now, I am in a position to say that this mere surmise of the editor of the S. A., is a matter of fact. Now to the proof: While in a gale at Quebec, the galvanized iron roof sheeting of four of the octagonal kiosks on Dufferin terrace remained untorn, which it had been on other occasions of severe gales; the fifth kiosk, situated in the midst of the other four, not only had its sheeting curled up and twisted and torn off, but the entire roof framing, all of cast iron, and bolted together, was bodily wrenched from its eight supporting columns, the confining bolts of each of which were broken off, and the whole roof, some 2½ tons in weight, carried up a height of say 40 ft., and over a distance of some 300 ft., and deposited in a broken and demoralized condition on the glacis in rear of the terrace. Now, it is evident that in this case there was within the general stream of easterly wind blowing up the St. Lawrence and striking the terrace, an intensified current which struck the demolished structure; a stream within a stream, so to say, as with the "Gulf Stream" in the ocean. I reduced the thing to figures at the time (some ten years ago, or less), and found that while the anemometer at the Quebec observatory on the occasion indicated only 59 lbs., the stress on the roof of the kiosk, thus to tear it away and hurl it to such a distance, must have had a cyclonic force of not less than 100 to 120 lbs. to the square foot. The same thing occurred in the United States a few years ago, when as I then showed in a letter on the subject, published in the Engineering Record, of New York, while the general force of the wind-storm was insufficient to do the mischief, there must have been within the moving river of air, the rush of air in motion, a more intensified stream which struck and overthrew two of the 500 ft. spans of the Jeffersonville bridge, each of which weighed not less than 1,000 tons.

But this does not explain nor in any way account for the difference herein-above alluded to, of the effect of wind currents on areas of varied extent. I think, Mr. Editor, I can account for this. It will be remembered that I was the first, at the time, and for some months before the attention of the world at large had been called to the apparent paradox, to explain (and your journal to publish), the so-called nozzle mystery, which I did by showing that the issuing circumferential jet of water carried with it by

friction, the water in the rear of the ball, thus creating a vacuum against which the pressure of the atmosphere reacted to keep the ball in place. Now precisely the same thing happens with the anemometer, and the more so the larger its surface or extent; the wind passing around its periphery sucks out the air in rear of it, creating a vacuum against which the atmosphere pressure on the opposite side reacts.

It will be noticed that while in the case of the Forth bridge, as stated, the larger area of experimentation, 300 ft., gave a wind pressure of only 40 per cent. less than that indicated by the ordinary anemometer; in the case of the Tower bridge, the 5,000 ft. area of the bascule experimented on, reduced the anemometrical pressure of from 6 to 9 lbs., down to from 1 to 1½ lbs.; or not only by 40 per cent., but by from 400 to 600 per cent—this difference being due to the proportional circumferential or linear peripheries of the surfaces experimented on, in comparison with the areas at play, the peripheries varying only as the linear dimensions, while the areas varied on the squares of those dimensions.

For instance, if the anemometer were a foot square, its area would be but one ft., while its periphery were four ft., or the area to the circumferential dimensions, in the proportion of ¼ to 1. With a surface of 10 x 10 ft., the area would be 100 ft., and the periphery 40; area to circumference as 2½ to 1; again, if the surface played on by the wind were 100 x 100 ft., the area would be 10,000 sq. ft., while the periphery were only 400 ft., or the ratio of area to circumference, that of 25 to 1, leaving the wind to act on or around edges of 4', 40', and 400', respectively, while the atmospheric pressure were exercised against areas of 1,100 and 10,000 sq. feet, and thus explanatory of the fact that the greater the area acted on, the greater the reduced percentage of pressure indicated by the larger surface.

C. BAILLAIRGE,
Consulting Engineer, Que.

October 7th, 1898.

Industrial Notes.

James & Reed, Perth, Ont., are enlarging the output of their machine shop.

The new Methodist church, at Madoc, Ont., will be of brick, and cost $12,000.

W. W. Carter is making a large extension to his stave and hoop mill at Fesserton, Ont.

The Pembroke, Ont., Milling Company will build an elevator close to the P.S.R. track, in Pembroke.

The new Intercolonial Railway grain elevator, at Halifax, N.S., is now being built by M. E. Keefe, of Halifax. The contract calls for its completion by January 1st next.

Robert Murray has his new machine shop at Rat Portage, Ont., finished. It is connected with Richard Hall's new marine slip. The entire plant will cost upwards of $10,000.

The Berlin, Ont., Brush Co., will move to Waterloo, Ont., as the former town failed to raise the $1,000 by private subscription that it was proposed to lend the company.

The boiler and machine shops of the British Columbia Iron Works, Vancouver, B.C., are starting up after being idle for many months, owing to the financial embarrassments of the company.

The Canadian Rand Drill Co. requires larger premises for its business, and is asking a free site and a bonus of $20,000 from the city of Sherbrooke, Que., where it has been located for some years.

At a meeting of the council of the town of Farnham, Que., a Montreal furniture manufacturer offered to start an extensive furniture factory here, in consideration of a bonus of twenty thousand dollars.

W. J. Finlay, of Lawrence, Mass., brother of J. D. Finlay, superintendent of the Toronto Paper Co.'s mill, at Cornwall, Ont., has been appointed manager of the mills of the Sturgeon Falls Pulp Co., Ltd.

H. S. Dowd will build a large oatmeal mill at Quyon, Quebec.

E. Gilbault, St. Boniface, Man., has purchased the barb wire works on Lombard street, Winnipeg, and will run the establishment in conjunction with his tin box factory, which will be moved from St. Boniface.

Among other matters of interest in the annual report of the City Engineer of Toronto, is the statement that a new bridge on the Humber river, at the Lake Shore road, will be necessary next spring. Estimated cost, $13,000.

A. A. Scott, Toronto; T. B. White, Kolapore, Ont.; W. Johnston, J. L. White, Heathcote, Ont., and Lizzie K. Scott, Toronto, have applied for incorporation as The Forest Product Company, Ltd. Chief place of business, Toronto; capital, $40,000.

Pierre Mahy, a window-glass blower, of Rensart, Belgium, states that a group of skilled window-glass workers from Belgium, desire to migrate to Canada, and work at their trade here. Besides manufacturing window-glass, all sorts of fluted and cut glass could be produced.

J. H. Chewitt, president of the Rossin Hotel Company, Toronto, has announced that it has been determined to make improvements to the hotel, amounting to $150,000. As soon as the weather will allow, work will be begun on the lower floor entrances. The plans include an addition.

The Canadian Oil and Coal Company, Ltd., has applied for a Dominion charter to locate and develop petroleum wells and coal mines. The chief place of business is Montreal; capital, $1,000,000; incorporators, W. Strachan, J. W. Pyke, B. Shepherd, G. H. Meldrum, Montreal; Hon. A. W. Cole, Albany, N.Y.

A by-law to fix for ten years the rate of taxation of the Ontario Rolling Mills Company, Hamilton, Ont., at $1,200 a year, in consideration of the establishment by it of a horseshoe factory, in the building erected for the manufacture of cut nails, but unused for several years, has been introduced into the Hamilton city Council.

The Taylor Hydraulic Air Compressor Company has, it is stated, completed a sale of its rights for the greater portion of the United States, the price being $200,000. This sale has been effected as a result of negotiations pending for some time, and was made after a thorough inspection of the working of the hydraulic air compressing plant at Magog, Quebec.

The Robb Engineering Co., Amherst, N.S., has received an order from New York for two 300-h.p. engines for an electric railway in Australia. They are tandem, compound, side crank pattern, and the dynamos will be direct connected. This company is working up a considerable export trade, having shipped during the past few months one 300-h.p. engine to England, three 125-h.p. to the Isle of Man, three 125-h.p. to Spain, and one 125-h.p. to Newfoundland.

The St. Thomas, Ont., Brass Co., which has erected a foundry and warerooms, has for proprietors the owners of the Buffalo Brass Co., Ltd. H. H. Hewitt is the president, and they have several branch establishments throughout the United States. The chief matter for comment about the new Canadian firm is that it has settled down to business without the customary period of bonus hunting, and evidently proposes to do business because business is profitable, not because the doing of business may be the cause of the receipt of unearned profits, as in the case of a crossing-sweeper's "tips."

Sissiboo, N.S., Pulp Co., on the river of that name, has four turbines, capacity, 17,000 horse power, and has, states the Weymouth, N.S., Free Press, four grinders, three wet machines, two hydraulic presses, a smaller packing press, and the necessary repair shops, and an electric light and steam heating plant. The mill works day and night throughout the greater part of the year. Scarcity of water in certain seasons sometimes necessitates a suspension. This difficulty, however, has been largely overcome by the construction of reservoirs at convenient stations on the upper part of the river. Some twenty-five tons per day is the average output of the mill, which consumes annually about 3,000 cords of spruce. Employment is furnished to twenty-six men.

A fifty barrel flour mill has been established at Grenfell, Assa., by a local company.

The Bailey Cutlery Co., Brantford, Ont., is now an established industry, having started up November 4th.

Parrish, Lindsay & Co. will erect elevators at Argue and Barber, Man., new towns on the Belmont, Man., extension of the Northern Pacific.

The Ottawa Stock-Yards Abattoir Company, Ltd., has been incorporated, with a capital of $50,000, to carry on an abattoir and stock-yards business.

The Massey-Harris Co., Brantford, Ont., has recently installed a very complete system of fire protection, including a pump with a capacity of 1,500 gallons per minute.

Two new elevators are being built at Arden, Man. One for John Davidson & Co., the other for R. C. Ennis, both of Neepawa. They will be of 25,000 bushels capacity each.

John Reeb & Sons, Port Colborne, Ont., have bought out the Welland, Ont., gas company, and have assumed control. The price paid is said to be $17,000, which includes the five wells and the plant.

Sarnia, Ont., is unable to accept a tender to pipe the streets and supply gas in the town at 25 cents per thousand, as it is found that the present gas company's charter confers an absolute monopoly.

The town of Barrie, Ont., carried a by-law to raise $100,000 to purchase the existing waterworks plant and make extensions to suburban parts of the town. The vote was taken November 7th.

At a public meeting held in Ottawa, Ont., last month, resolutions were passed urging the establishment of technical schools, and the Ottawa Board of Trade has appointed a committee to move in the matter.

The degree of B.Sc. (Bachelor of Science), which it is proposed to substitute for that of B.A.Sc. (Bachelor of Applied Science), now granted at McGill University, will be much more easily understood by the public.

We understand that the Caledonian pottery of Campbell & Purvis, St. Johns, Que., has shut down for a short time. The works of the Canada Stone Chinaware Co. also continue closed, pending the negotiations of Lavoie and Aube with the directors in Paris.

At a meeting of the People's Heat and Light Company, Halifax, N.S., November 16th, it was decided to issue $100,000 worth of second mortgage debentures, bearing interest at 5 per cent., repayable in 15 years. This is to meet the cost of the new plant.

The Laurentide, Que., Pulp Co. has decided to purchase the Grand'mere falls from the government, together with several islands above and below. The matter has gone into arbitration, and the arbitrators are Stewart Howard, C. E. Gauvin, and S. P. B. Casgrain.

Charles C. Dodge, Samuel F. Roop, Warren E. Roop, Oberlin A. Rogers, Ezekiel M. Barteaux, George E. Hutchinson, Edwin S. Dodge, Angus J. Morrison, and Thomas R. Jones are the provisional directors of the Middleton, N.S., Wood-working Co., Ltd., which will carry on a general wood manufacturing business; capital, $10,000.

The working force of E. Leonard & Sons, engine and boiler makers, London, Ont., has, says a special correspondent of the Toronto Globe, in a recent issue, been increased nearly 50 per cent. At the same time much overwork has been found necessary to fill orders on hand. Improved machinery has also been put into this establishment, so as to turn out heavy engines for electrical purposes.

Of Dundas, Ont., a correspondent of the Monetary Times says in a recent issue: "There is decidedly more activity in business generally, especially since the Toronto, Hamilton & Buffalo Railway reached the town one year ago. The old established firm of John Bertram & Sons were never more fully employed, and they employ 225 hands. The senior member of this firm has been in business in Canada since 1861, and the present tool works cover 60,000 square feet of space. There is now being added a tool shop, covering 10,000 feet additional, to erect machinery for heavy work, besides a new branch for paper mill machinery.

The Grand Trunk Railway freight business is increasing so rapidly that the company is now considering the question of erecting another new elevator at Midland, Ont.

The ratepayers of Oshawa, Ont., will shortly vote on a by-law to raise funds to build the waterworks and sewage disposal system, for which John Galt, C.E., the new city engineer of Ottawa, Ont., has made the necessary plans and estimates.

A public meeting was held in St. John, N.B., a short time ago, and the establishment of a pulp mill at Woodstock, N.B., was discussed. A committee has the matter in hand, and an expert from the United States has been called in. A forty ton mill is contemplated.

The property of the Gardner Tool Co., Ltd., Sherbrooke, Que., in liquidation, was sold November 15th at auction. The stock, valued at some $15,000, was purchased by William Farwell, manager of the Eastern Townships Bank, who also bought the real estate at $600, subject to the claim of the city of Sherbrooke of $18,000.

J. Dobson, C. J. Webb, Philadelphia; R. Peverley, New York; R. T. Hopper, R. D. McGibbon, Q.C.; T. C. Casgrain, Q.C., and W. F. Robinson, Montreal, are to be incorporated as The Beaver Portland Cement Company, Ltd., to manufacture Portland and other cements, and pressed brick, drain pipes, etc.

The Fossil Flour Company, operating at Castlereagh Lake, says the Truro Guardian, has been working all summer, with a goodly number of men, the output being about ten tons per day. The coarser grades of the material are largely used in the manufacture of rubber for fireproof packing. The finer grades are used in various arts and sciences.

An Ontario charter of incorporation has been granted to the North Shore Timber Company, of Port Arthur, Ont. This company is the outgrowth of the firm of Hazlewood and Whalen, pulp wood contractors. The new company is capitalized at $60,000. The members of the company are P. Weidner, E. W. Voight, O. L. E. Weber, A. K. Kiefer, of Detroit, Mich., and R. A. Hazlewood and James Whalen, of Port Arthur. The object of the company is to carry on a general lumbering and pulpwood business.

The Dominion Vinegar Works, Hamilton; the Hamilton Distillery Vinegar Works; A. Haaz & Co., Kingston; S. Allan, Norwich; William Wilson, T. A. Lytle & Co., and the Badgerow, Scott Co., of Toronto, have united and formed a trust. The trust is known as the Wilson-Lytle-Badgerow Company, of Ontario, Limited, with a capital stock of $600,000. William Wilson, Toronto, is president, and William S. Scott, of Badgerow & Scott, is secretary-treasurer. A vinegar factory, for the trust, is being built at the corner of Front street and Spadina avenue, Toronto, at a cost of $150,000. Orr Bros., Toronto, have the contract.

Recent cable despatches in the Montreal Star stated that British capital for iron shipbuilding in Nova Scotia was to be forthcoming, and that the plant would be established in Cape Breton, where cooperation with the Dominion Coal Company would be assured. The iron ore is found in great quantities on the southern cost of Cape Breton, and this, it is said, will be treated at a smelter erected at Louisburg, C.B. The erection of a shipbuilding plant would follow the development of the iron works. So far, the Dominion Coal Co. has not been approached by anyone with any proposition of this kind, though it writes us that it would be glad to cooperate with any company undertaking such a development.

A. W. Campbell, Provincial Instructor of Roadmaking, has returned from Washington, where he has been attending the Municipal Improvements Convention. A great number of subjects was discussed by experts from the United States and Canada, on sewage systems and disposal, waterworks, construction of pavements and roadways, laying out of parks, and tree planting. "The ideal roadway," he said, "was constructed of asphalt blocks, of which many miles had been laid in New York, Boston, Baltimore, and Washington. Sprinkling asphalt at night is the proper method. It prevents the dust and does no injury, but it should be well flushed, in addition, once a week."

There is some prospect of a pulp mill being started at Bathurst, N.B.

The Andover, N.B., waterworks are completed, and the water has been turned on.

Revelstoke, B.C., is to have a sawmill with a cutting capacity of from 25,000 to 35,000 feet per day.

The Watson & McDaniel Co. report a large and increasing demand for the new Jennings Blow-off valves.

The stone work on the piers and abutments of the new inter-provincial bridge, Ottawa, Ont., is very near completion.

The city engineer, Hamilton, has reported in favor of laying the new $160,000 water main by day labor instead of contract.

W. H. Fowler proposes to at once erect a flour mill of 400 barrels daily capacity near the head of Rodney wharf, St. John, N.B.

The Sheffield Cutlery Company, of Montreal, has been incorporated in Quebec; capital, $10,000. The purpose is to make cutlery.

The property of the Ontario Wind Engine and Pump Co., Toronto, has been exempted from taxes for ten years from January 1st, 1898.

The vote on the $50,000 by-law for the purchasing of the Waterloo, Ont., waterworks plant from a private company was voted down by the ratepayers November 21st.

On November 22nd the entire long span between the piers of the Ontario end of the bridge across the Ottawa at Portage du Fort, Que., suddenly gave way, and fell into the river.

It is now an assured fact that at least two of the big saw mills at the Lake of the Woods will be removed to Winnipeg on the completion of the Southeastern Railway to Rainy River.

The Canadian-American Glass Co., recently organized, will establish a large plant at Kingsville, Ont., and will absorb the R. M. Leggett Bottle & Glass Co., Detroit. The Detroit concern has a capacity of 90 tons per day.

Rolland Brothers, importers and manufacturers of cabinet hardware, upholstery goods, etc., Montreal, are about to remove to either Roxton Falls or Farnham, Que., each of which places has offered them a bonus of $20,000 to locate there

H. E. Moffat, J. A. Bain, E. A. Brown, G. de C. O'Grady, and J. G. Wallace, Woodstock, Ont., have been granted an Ontario charter as the Moffat Feed-Water Heater and Purifier Company of Woodstock, Ltd.; capital, $40,000; chief place of business, Woodstock, Ont.

There are points still to be learned about belting, as all power users will admit. Some of these are stated in another column, in the advertisement of W. A Fleming, Montreal, Canadian agent for Reddaway's Patent Camel Brand Belting, which as all know has been the subject of one of the most famous patent law suits in Great Britain.

The Economy Manufacturing Company of 613 Washington Life building, 141 Broadway, New York, has just completed the installation of a hydro-carbon gas fuel system at the plant of the B. Greening Wire Company, Ltd., Hamilton, Ont. This plant was equipped under the superintendence of H. Etches, M Inst. Mech. Eng., 83 Front street west, Toronto.

C. C. Dodge, S. F. Roop, W. E. Roop, Oberlin A. Rogers, E. M. Barteaux, G. E. Hutchinson, E. S. Dodge, A. J. Morrison, J. H. Charlton, W. H. Chipman, A. E. Lawson, W. G. Parsons, F. E. Cox, Middleton, N.S., and Thomas R. Jones, Nictaux, N.S., have applied for a charter as the Middleton Wood Working Co., Ltd.; chief place of business, Middleton, N.S.; capital, $10,000.

The Robb Engineering Co., of Amherst, N.S., received the following orders within a few days: Five boilers for fog horns from the Department of Marine and Fisheries, a 100 h.p. engine and boiler for the new electric station at Campbellton N.B., a 40 h.p. engine for the electrical plant of the St. John elevator, a 25 h.p engine for the Ogilvie Milling Co., Winnipeg, a 15 h.p. engine for S. Raworth, Port Elgin, N.B., and an 80 h.p. engine for Kilgour Shives, Campbellton, N.B.

The proprietors of Delahay's moulding foundry, Pembroke, Ont., placed a new man over their old foreman last month. The latter resented this and left his work, and the employees struck, to show that their sympathies were with the old foreman.

The new dynamite and powder factories for the Ottawa Powder Co., near Ottawa, are completed. There are seven frame buildings, including magazine, nitro-glycerine house, soda house, pulp house, packing house, root house and engine house.

H. Mooers, E. Mooers, A. B. Campbell, W. J. Doble, Kingston, Ont., and H. F. Mooers, Goderich, Ont., have applied for a Dominion charter as The Frontenac Milling Company, Ltd., to do general flour milling business throughout Canada; capital, $50,000.

According to the Woodstock, N.B., Despatch, there is a possibility of the old Upper Woodstock Iron Works being put into operation, after having been closed down for many years. In 1864 these works produced about 2,750 tons of iron, and employed 75 men.

Belleville, Ont., has passed the by-law relating to the Mitchell-Abbott Iron & Steel Company by a majority of nearly a thousand. The company is composed of Frank A. Mitchell, of Norwich, Conn., and William Abbott, of Montreal. The by-law gives the company free land, exemption from taxation and a bonus of $50,000, to establish rolling mills, etc., in Belleville.

The raising of large boulders in the St. John, N.B., harbor is being accomplished in an interesting manner. A boulder, which weighs many tons, had been slung by the diver with chains. The chains and ropes on the hoisting scows were easily broken in trying to lift the heavy rock. The boulder was again slung, and at low water two scows were brought into use with strong timbers across them. The hoisting gear was secured to the timbers and as the tide raised, the scows lifted the boulder, and at high water the large rock was placed out of the channel.

The Lancaster Machine Works, Lancaster, Ont., have placed on the market something new and good in a pumping engine for creameries and milk skimming stations, by means of which they can operate from one to five pumps. Several attempts have been made to get up an effective pump for this purpose, but it remained for this enterprising firm to surmount the difficulties met with in former makes and give to dairying a complete machine at a low cost. There is already a good demand for them, so the company informs us.

The steel grain storage plant of the Canadian Pacific Railway at Fort William, Ont., is now in operation. The capacity is 3,000,000 bushels, consisting of a series of steel tanks which are airtight, and being also fire-proof, no insurance is carried. The elevator building proper is built of structural steel, with one-quarter inch steel plate floors, supported on "I" beams, the steel frame being covered with heavy corrugated steel. It contains the scales, steel circular garners, steel elevator legs, power shovels, carpuliers, warehouse, separators, steel spouting, transmission machinery, and fixture for the weighing and transferring of grain from cars to tanks, or direct to vessels. Two belt galleries run over the top of the tanks. They are built of steel, and contain two belt conveyors, each with trippers for distributing grain to various tanks, or direct to vessels. The shipping capacity is 40,000 bushels per hour. The unloading capacity is 400 cars per day. The boiler and engine-house is built of Lake Superior stone, with steel truss roof, and contains one 400 horse-power condensing engine; three boilers, 66 inches by 16 feet, with all the necessary pumps and fixtures. The power is transmitted from the engine to the steel house by a 400 horse-power rope drive. Tunnels constructed of stone under the tanks contain the belt conveyors for transferring grain from the tanks to the steel building, where the grain is weighed and shipped to vessels by means of the conveyors in the steel galleries over the tanks; dock spouts being attached to the end of the galleries for receiving the grain from the belt conveyors. There are 16 steel tanks, 58 feet in diameter, by 60 feet high, and 32 tanks 20 feet in diameter by 60 feet high. The tanks are ranged side by side, the smaller tanks in a double row, flanked on each side by a row of eight big tanks.

At the recent annual meeting the following officers were elected by the Architects' Association, province of Quebec: President, A. Raza; first vice-president, S. H. Capper; second vice-president, G. E. Tanguay; secretary, Joseph Venne; treasurer, N. E. Doran; auditors, A. Chausse and Heriot; counsellors, Peachy, A. T. Taylor, G. A. Monette and Archibald.

As we go to press we learn that the Canadian Motor Syndicate has completed negotiations for the purchase of a block of land in the central part of Toronto, on one of the main street car lines, and for the immediate erection of a building 40x60 feet. The syndicate is on the look-out for business in various lines, both in electrical and hydro-carbon departments.

W. German, M.L.A., Welland; James Battle, Thorold; W. Thompson, St. Catharines; George Dawson, St, Catharines, and Joseph Battle, Thoroid, composed a deputation from Welland County, which recently waited on the Minister of Railways and Canals, seeking for increased water-power privileges on the Welland Canal. The subject is a difficult one for the Government, because while at certain seasons of the year power can be supplied from the canal without inconvenience, yet the complaints which always attend the necessary unwatering of the canal, are a source of considerable trouble to the Government.

The death of John W. Keeley closes the history of one of the most remarkable stories of the century. Mr. Keeley professed to have discovered a new motive power and to have invented a machine to utilize it. The motive power was the ether which permeates all space. He succeeded in convincing great capitalists that his claims were well-founded, and hundreds of thousands of dollars were supplied him for carrying on experiments. But his motor never worked successfully, and he has died without revealing whether he believed himself in some real discovery, or whether he was merely deceiving the public.

City Surveyor St. George, Montreal, and Engineer Janin, who has been given the contract for establishing a sewage farm in St. Denis Ward, Montreal, made recently a trip to a number of cities in the United States, where sewage farms are operated. These were carefully inspected and the result was highly satisfactory both to Mr. Janin and Mr. St. George. Both have stated that the St. Denis Ward establishment would be constructed so as not to be in the slightest degree a nuisance. At Brockton, Mass., the sewage farm skirts the main road and houses are built within a few feet. There is no smell at all from it, the engineers say. Its size is twenty-three acres, all of which are under cultivation. The population of Brockton is 33,000.

Approval has been given by the Ontario Board of Health to the plans of the proposed waterworks for the village of Stirling, Ont. The supply is to be taken from Oak Lake, about 300 feet above the village, and transported in iron pipes. The board feared that there might be danger of pollution to the water supply, but learning that the water was required mainly for fire protection, agreed to the plans subject to the understanding that changes should be made in the event of the proposed system proving dangerous to the public health. The Board has interdicted for the present the construction of a ditch between Welland and Port Colborne, whereby it was proposed to drain Humberstone marsh into the Welland canal. This action was taken on the complaint of Dr. Goodman, the Health Officer of St. Catharines, who pointed out that the proposed drainage scheme would result in the pollution of the Welland canal, from which the water supply of St. Catharines is derived.

FIRES OF THE MONTH.

Nov. 3rd. G.T.R. freight sheds and G.N.T. steamer "Pacific," Collingwood, Ont.; loss, $100,000.——Nov. 8th. Paul Bros'. planing mill, Midland, Ont.; loss, $5,500.——Nov. 11. Wellington, B.C., coal mining engine house, $15,000.——Nov. 12th. Pillow & Hersey bolt works, Montreal, loss covered by insurance.——Nov. 13th. Jos. Shearer's planing mill, Montreal, $10,000.——Nov. 26th. Stevens Manuacturing Co., London, Ont.; damage about $10,000.

—A. E. Payne, E.E., who has been employed by the Royal Electric Company for the past four years as a traveler, will in the future represent the Packard Electric Co., St. Catharines, and R. E. T. Pringle, Montreal.

Mining Matters.

Mica is being profitably worked in the vicinity of Kingston, Ont., this season.

R. Wood, Snow Road, Frontenac county, Ont., claims to have discovered there a vein of ore which contains nickel in paying quantities.

Thomas Byrne, P.L.S. has returned from Michipicoten, Ont., where he has made extensive surveys on behalf of the Ontario Government.

It is said that deposits of iron ore which may be used to produce speigel have been discovered in Cape Breton, and will be extensively worked.

A large flow of natural gas is reported from a well being drilled on Wm. Bellimer's farm at Ryckman's Corners, a few miles from Hamilton, Ont.

The Hall Mines Company, Nelson, B.C., is said to be arranging with the Kootenay Light and Power Co., for power to run the mine and the smelter.

R. H. Ahn is establishing a reduction works at Norman, Ont. The mill is intended to treat the ores of a number of properties in which he is interested.

Five hundred and twenty-nine dollars and twenty-five cents is the value of the first gold brick produced from 33 tons of ore from the Treasure mine, eight miles to the southeast of Rat Portage.

A School of Mines is being established in Rossland, B.C. The following have the matter in hand: E. Durant, J. Martin, W. A. Carlyle, C. O. Lalonde, S. Curtis, R. Adams, J. P. Hennessy and A. Cameron.

Another discovery, said to be of very rich gold quartz, has been made in the new district situated to the southeast of Rat Portage about seventy miles, known as the Sturgeon and Deer Lakes district.

A sample of galena from Great Slave lake was recently sent by J. A. McDougall to Dr. Dawson, director of the geological survey, for assay. The assay shows silver at the rate of 16 ounces to the ton.

A gas well has been discovered on the farm of A. Markham, Tilbury North. An artesian well was being bored for water, when a very large flow of gas was struck. It is proposed to pipe the gas to Chatham, Ont.

The Grand Calumet Mining Company has discovered a rich zinc mine near Rossport, in the Algoma district, and intends opening it up at once. It will be worked all winter. The company has several mines at Calumet Island and has formed quite a settlement there, having erected cottages for the workmen, about sixty in number. The company has shipped 1,500 tons of ore during the past summer, principally to Antwerp, Belgium, the value of which was about $30,000.

The question as to the relative cost of hand or of machine drilling is contributed to by some data obtained by The Rossland, B.C., Miner from J. B. Hastings, the manager of the War Eagle Mining Co. Mr. Hastings keeps probably the most complete account of the expense of working that is to be found in the northwest: In estimating the cost of any work, he includes the cost of management, clerical work, interest, depreciation of the plant, legal fees, and in fact every item of expense which the mine undergoes. In this way his figures are useful for basing estimates upon the various outlays for mining development. It has been contended that hand work is actually cheaper than machine work, as less powder is required, while the expenses of fuel, plants and engines are not experienced. Mr. Hastings' figures show that for drifting by hand the total cost was $35 per foot, while with a machine under similar circumstances the total charges amounted to $17.50 per foot. In the item of underhand stoping, the difference in favor of machines was even greater, for there one stope was worked by hand at an expense of $7.50 per ton, while with a machine the total cost was only $2.50.

Senator Snowball, Chatham; F. P. Thompson, Fredericton, N.B.; J. L. Black, Sackville; Willard Kitchen, Fredericton, N.B., have purchased 57 per cent. of the Modstock Gold Mining Co., whose property is located at Forest Hill, Guysboro, N.S., for $22,800.

R. H. Gibson, Bradford, Pa., who has been exploring lands on Manitoulin Island since April last for petroleum, claims to have been very successful, and struck oil in four wells. He is now engaged in sinking a fifth. The oil was struck at 450 to 600 feet. In two of the wells natural gas and rock salt were struck.

The Le Roi passed into the possession of the British-American Corporation at a meeting in Spokane, Nov. 23rd, when J. C. Mackintosh was elected president, and other directors of the B.A.C. were also elected to office in the Le Roi Co.

Gold mining circles in Nova Scotia are much exercised over the rumored discovery again of the "Rose lead," so-called, in the Montague gold district near Halifax. It is said to have been traced over three properties and is wonderfully rich in gold.

Among the northern mines there are two sections more than any others that at present are looked to as possible rivals of the Klondyke, these being the Atlin Lake field at the northern extremity of British Columbia, and Thistle and Blueberry creeks, just south of the Stewart river. The discoveries at these latter diggings are more recent than the Atlin finds, and definite reports are only now commencing to make their appearance. One of the best of these is furnished by G. H. Bunn, an experienced miner and a member of the Scroggie party—discoverers of the creek of that name—who has come direct from the new scene of mining activity. He says: "Thistle creek is in my opinion one of the best and most promising gold streams of the whole north country. It is on the right side of the Yukon, and enters that river at a point about twenty miles above the Stewart, heading on the opposite side of the divide at a point from the west fork of Scroggie creek, only a few miles from that fork. The mouth of the creek is not visible from the Yukon, as it enters what is called a blind slough, and persons coming down the river do not notice it. The discovery on Thistle was made by a party of eight Scotchmen who had been prospecting in the neighborhood since last July."

The following return recently published in The Montreal Gazette shows the export of minerals from Newfoundland for the year ending June 30, 1898. Copper ore, 38,915 tons to the United Kingdom; copper ore, 17,801 tons to the United States; copper regulus, 9,616 tons to the United Kingdom; iron pyrites, 15,724 tons to the United States, manganese, 1,500 tons to the United States; arsenical pyrites, 125 tons to the United States; iron ore, 44,627 tons to different places. These figures show a steady advance in the mining industry and sufficiently indicate that the product of the mines is taking an important place among the exports of Newfoundland. In the current year (1898-99) there will be a very large increase in the export of iron ore, for which there is an unlimited demand in Great Britain. Before the end of this year there will be 100,000 tons shipped from the iron mine at Belle Isle—or more than double that of last year. The shipping of ore from the new iron mine at Bay de Verde will commence by May next. Shafts are now being sunk, and a railway, five miles in length, to the port of Old Pelican, is under construction, and the output is expected to be very large. A wealthy syndicate, says the correspondent, among whom are some of the great ironmasters of England, have leased this valuable mine, and will work it on a large scale. The vein is sixteen miles in length, and is estimated by experts to contain forty million tons of the finest quality, equal to that of Lake Superior. In the same peninsula, half a dozen more veins of iron ore have been discovered, and now await development. At Grote's Point, too, new discoveries are announced. In fact, the whole district around seems to be highly mineralized. It is evident that Newfoundland will take a high place among the iron-producing countries of the world. Then in copper, of which some ten million dollars' worth have been exported in the last thirty years, there are satisfactory advances. Tilt Cove, the oldest mine, is more active and more productive than ever. Little Bay, which was supposed to be exhausted, has lately taken a new departure, a new copper vein, nine feet in width, having been discovered, and is now worked by a London company. On the west coast, at York Harbor, Bay of Islands, there is also a discovery of copper which promises well.

Railway Matters.

A collision on the Grand Trunk Railway between Montreal and Toronto resulted in the death of 12 persons, Nov. 14th.

J. G. McIntyre, who for over 40 years has been a foreman boiler-maker with the G.T.R., and who for the past ten years has been employed at the Grand Trunk shops at Stratford, Ont., has been dismissed.

Application will be made for a charter for The Arthabaska Railroad Company to build a railway from Dudswell, on the Quebec Central Railway, in Wolfe county, to Maddington Falls, in Ste. Anne du Sault, on the Intercolonial Railway.

By the explosion of a locomotive boiler a terrible accident took place Nov. 10th, on the C.P.R. one mile east of Shuswap, Kamloops, B.C., two men lost their lives, and one was seriously injured. The dead are: E. Reid, brakesman; James Little, engineer John George, the fireman, was badly scalded.

The Rutland & Canadian Railroad Bill has been passed by the Vermont Legislature. The bill passed incorporates the Rutland & Canadian Railroad Company, with a capital stock of $1,000,000, giving it the right to construct a road from Burlington to the Canadian line. The construction of this line will give the Vanderbilts a line from New York to Canada and the great lakes.

The Canadian Locomotive and Engine Works Company, Kingston, Ont., has received the contract to build six locomotives for the Canadian Pacific railway. They are to be compound engines. The largest passenger engine ever built in Canada has just been completed at these works, being the first of five being built for the Intercolonial. The driving wheels are 72 inches in diameter; the boilers are designed to carry a pressure of 180 lbs. to the square inch; the water tank will hold 3,600 gallons and the tender nine tons of coal. The engine weighs 70 tons, and the tender 44 tons, a total of 114 tons. It is fitted with the latest improvements.

A change was made about the 1st November in the management of the G.T.R. locomotive shops in Stratford, over which J. Davis Barnett has presided for so many years, first as assistant superintendent, and latterly, under the terminology of the new management, as master mechanic. Mr. Barnett has resigned, and he handed over his responsibilities to J. McGrath, the foreman of the erecting shop, who now has charge, under the designation of general foreman. The position of master mechanic at Stratford is abolished. The new general foreman is quite a young man, and was born in Toronto. He entered the old Northern railway shop in 1882, and gradually rose to be foreman of the Toronto locomotive repair shops, whence he was sent to Stratford about six months ago to become foreman of the erecting shop there, in succession to A. A. Mayer, who was transferred to London.

The Department of Militia, as soon as the necessary arrangements can be effected, will commence the erection of a new building for militia stores at Ottawa. It will be located on the tennis grounds in the rear of the drill hall and will be a four story brick building with adequate accommodation for the storage of the militia supplies for the Dominion. It is expected that the structure will be begun in a short time and completed early in the spring, and this being the case the present quarters at the canal basin will be vacated. When this is done J. R. Booth states that work will be commenced on the new Ottawa Union station. As before stated, the location will be on the site of the present depot and will extend to the bridge. The big building will contain the offices of the railway companies using it, each of which will be on an equal footing and furnish their proportionate cost of its maintenance.

The Central Ontario Railway is to build a spur from Ormsby to Bancroft, Ont.

Trains have begun running into Pembroke over the Pembroke Southern Railway.

Application is being made for a British Columbia charter for a railway from Kamloops Lake to Atlin Lake.

The C.P.R. has arranged to make extensive improvements at Laggan, B.C., including the erection of a stone five stall round house.

The Lake Manitoba Railway & Canal Company has decided to complete another 25 miles of the Swan River extension at once.

Wm. Strachan, president of the Midland, N.S., Railway, and Peter Lyall, one of the directors, recently made an inspection trip over the road.

The necessary money for the charter, surveys and other preliminary expenses for the Thunder Bay & Nepigon Railway has been subscribed in Port Arthur, Ont.

The Ottawa & Parry Sound Railway during the season of navigation just closed, carried twelve million bushels of grain and 100,000 tons of flour and pork from Parry Sound through Ottawa.

Large seizures have been made by the Customs Department of the Dominion involving eighteen locomotives and one thousand box cars, belonging to the Booth system of railways, with headquarters in Ottawa, Ont.

A report is current in Vancouver, B.C., that the Great Northern Railway will bridge the Fraser River at New Westminster and run a line into Vancouver, connecting with the Westminster Southern Railway, part of the Great Northern system. This new line will give the Grand Trunk Railway an entrance into Vancouver via its Chicago connections.

Application will be made at the next session of the Dominion Parliament, for an act to incorporate a company to construct a railway from Dawson, along the Klondyke river to the confluence of Hunker Creek, along Hunker Creek to Indian River, and along its course to its junction with the Yukon River, thence along the Yukon River to Dawson, with power to construct and operate a branch up Bonanza and El Dorado Creeks to Dominion Creek.

General Manager Whyte, of the C.P.R., took over the Crow's Nest Pass railway, on behalf of the C.P.R., on November 15 from Contractor Haney. The town of Fernie, B.C., is now a lively place. The 150 miners who arrived with their families from Halifax are now all at work. Seventy-five coke ovens have been built. In all there are to be about 200 ovens, which will turn out an average of 1¼ to 1½ tons per day each. This coke will be sent to the Nelson and Pilot Bay smelters. The coal at Michael creek, which is now being opened out, not far from Fernie, will produce as much coke per ton as the Fernie coal, says General Manager Whyte, and of much better quality for domestic use.

L. A. Hamilton, C.P.R. land commissioner, who has returned to Winnipeg accompanied by T. W. Tye, chief engineer of the Robson-Penticton branch which is being extended into the Boundary country, stated that while in Montreal they had located the principal townsites along the road. They will be Gladstone, Cascade, Grand Forks and Greenwood, and arrangements have been completed whereby the company has become interested in the development of the towns. Grand Forks is located at the point where the north fork of Kettle river flows into the main stream. Gladstone, which is situated 24 miles from Brooklyn, will be the distributing point for the Burnt basin and Christina lake. Cascade is situated on the international boundary at the foot of Christina lake, and is well supplied with water power for manufacturing and other purposes. Greenwood will be the principal mining point in the Boundary and it is surrounded on every side by developed mines, which are expected to start shipping ore to the company's smelter at Trail as soon as railroad facilities are provided.

Electric Flashes.

It is stated in Montreal that the Royal Electric Co. and the Montreal Gas Co. are to be amalgamated.

The Davidson Mnfg. Co., Montreal, has purchased a 30 h.p. induction motor from the Canadian General Electric Co.

The Canadian General Electric Co. are installing a 100 light electric plant for the Guelph Carpet Co., Guelph, Ont.

C. O. Beauchemin, Montreal, has purchased from the Canadian General Electric Co. a 30 k.w. generator of the multi-polar type.

The Canadian General Electric Co. is installing an electric plant of 100 lights capacity for the Williams Shoe Co., Brampton, Ont.

The North Hatley, Que., Electric Light Company is erecting its poles and putting on the wire, and will soon be in a position to furnish light.

Duncan & McLennan, who have the lighting contract for Campbellton, N.B., state that they will have the lights turned on by December 24th.

The Mispec Pulp Mills, St. John, N.B., are installing an electric lighting plant, and have purchased a 400 light dynamo from the Canadian General Electric Co.

The municipal council of Galt, Ont., and the Galt Gas Company have agreed upon the sum of $67,750 for the gas and electric light plants, which the company is willing to accept.

O. & W. McVean, Dresden, Ont., are installing an electric lighting plant for use throughout their various mills. The Canadian General Electric Co. is furnishing all the apparatus and wiring supplies.

The Canadian General Electric Co. has recently closed a contract with Geo. Matthews Co., Peterboro, for the installation of an electric lighting plant. The dynamo is to have a capacity of 150 lights.

The Toronto Electric Light Co. has placed an order with the Canadian General Electric Co. for a large power generator of the latest multi-polar type. This machine is to be wound to deliver current at 250 volts pressure, and has a capacity of 600 h.p.

The Ottawa Electric Co., Ottawa, Ont., is increasing the arc lighting capacity of its power station, and has placed an order with the Canadian General Electric Co. for two two-circuit automatic regulating "brush" arc dynamos, having a capacity for 125 arc lamps.

Dr. C. J. Edgar, manager of the Eastern Townships Light, Power and Carbide Company, has concluded the purchase of the water power at Nangle's Dam, near Rock Forest, Que. The company intends to transmit power for lighting and power purposes to Sherbrooke, Que.

Cornell Bros., Stanbridge East, Que., are installing an electric lighting plant, and have purchased for their requirements, from the Canadian General Electric Co., a 400 light dynamo of the latest multi-polar type, together with marble panel switchboard and wiring supplies.

The order for a 100 h.p. engine and boiler for the Campbellton, N.B., electric light plant, has been given to the Robb Engineering Co., Amherst, N.S., and for the electrical apparatus to the Royal Electric Co. Duncan & McLennan have the contract, and state that the lights will be lighted Dec. 24th.

The Lieutenant-Governor-in-Council, on the advice of the Attorney-General of Ontario, has referred to the High Court of Justice certain questions to determine whether the non-completion by the Niagara Power Company of the water connections to the extent of 20,000 horse-power, and 10,000 horse-power, actually ready for use, supply, and transmission by 1st Nov., 1898, has not put an end to the agreement between the Park Commissioners and the said power company, giving to the latter the exclusive use of the water-power at Niagara Falls.

The Little Salmon River Telephone Co. has acquired the right to carry its wires into St. John, N.B.

The capital stock of the Northern Electric and Manufacturing Co., Ltd., has been increased from $50,000 to $1,000,000.

A new copper telegraph wire is being strung over the Crow's Nest Pass railway, similar to the one between Montreal and Vancouver. It is also intended to string one into the Boundary Creek district as soon as the line can be built with safety along the Robson-Midway extension.

The municipality of Barrie, Ont., is conferring with the Barrie Electric Light Company regarding the purchase of the latter's plant. The town has placed $35,000 in the council's hands to be spent on a municipal plant, and the question now is whether the existing plant will be purchased or an entirely new plant installed.

Ancaster, Ont., township council has passed a by-law to extend the Hamilton, Chedoke & Ancaster Electric Railway Company's right of way on the highway for another term. The council also passed a by-law extending the time in which the company is to earn the township bonus of $5,000 from December, 1898, to December, 1899.

Notice is given that the Canadian Power Company will apply to Parliament at its next session, for an act to extend the time for the completion of its works, to extend the bonding powers of the company and to more particularly define its powers, and to change its name.

The city council of St. John, N.B., has offered to settle with the street railway, Sir Wm. Van Horne, and James Ross, Montreal, on a basis of five hundred thousand dollars valuation for taxation purposes. The offer is made to cover taxes due from 1895 to 1898, and to avoid litigation. The balance claimed by the city is thus reduced to about $19,500.

The Perth Waterworks Company has completed arrangements for the removal of the engine and boiler, formerly owned by the Tay Electric Light Company. This is a move which the company has adopted to assure constant power to its customers, as in the event of any disarrangement of the water power it would be impossible to supply light. Now steam will be used as an auxiliary power, and a more complete service is anticipated.

In re The Bell Telephone Company and the City of Hamilton, it was decided by the judge that in assessing, for purpose of taxation, the poles, wires, conduits and cables of the telephone company, the cost of construction, or the value as part of the concern, is not the test; they must be valued, in the assessment division in which they happen to be, just as materials which, if sold or taken in payment of a just debt from a solvent debtor, would have to be removed and taken away by the purchaser or creditor.

Thompson vs. The Brantford Electric and Operating Company., Ltd., was an action in which the defendants, by resolution of the Board of Directors, authorized their manager to purchase from the plaintiff, on certain terms of credit, a machine necessary for the carrying on of the defendants' business. The defendants' manager bought the machine, but on different terms, the plaintiff having no knowledge of the board's resolution; and the defendants received and used the machine. It was held, that the purchase was within the scope of the manager's authority, and that the defendants were liable for the price of the machine.

An accident occurred early last month to the dam which was being constructed at St. Gabriel over the Jacques Cartier river for the Canadian Electric Light and Power Company. The heavy rains had greatly swollen the stream, and caused it to overflow its banks, and large quantities of brushwood had also been brought down, and their pressure, combined with the weight of water backed up by the nearly finished work, proved too much for the dam, which gave way suddenly, and was carried down over the rapids. The men and horses working on the dam had barely time to get out of the way of the flood. The loss to the contractors, Ross & Barry, will be at least $2,000. The accident, however, did not cause any suspension in the operations, which were carried on as usual.

The Stouffville Electric Light Co. is making changes in its electric lighting station, among them being a new dynamo with a capacity of 500 lights. It is putting in an S.K.C. two-phase machine from the works of the Royal Electric Company, so that it can supply power as well as light.

The town of Campbelltown, N.B., is installing a civic electric lighting plant. It is putting in Robb-Armstrong high speed engines with Monarch boilers, and one 60 k.w. S.K.C. two-phase dynamo with the full capacity of the machine in transformers. They intend to use this S.K.C. machine for the supplying of arc lamps for the streets as well as incandescent light for interior lighting and for power in the daytime.

The lighting plant of the Stouffville Electric Light Company, which was installed about five years ago, suffered damage a short time ago by the armature bands breaking and wrecking the machine. In replacing this dynamo, there has been installed an S.K.C. inductor type machine, and it will do away with the possibility of having another wrecked armature, or a burnout, or troubles from brushes and commutators.

Acton, Ont., has decided in favor of a municipal electric plant, and municipal ownership of the lighting system is being actively canvassed in Pembroke, Ont., with a probability of being adopted. The Brockville town council has not yet decided in favor of municipal ownership, but if every elector in the town would persistently ask the councillors why it is that gas costs $2.50 per thousand cubic feet in Brockville and only 90 cents in Toronto it would not take them long to come to a decision in the matter.—Brockville, Ont., Times.

The dynamos at the Brockville, Ont., electric light station were stopped at night during the storm of November 17th and 18th on account of the inability to procure sufficient water for the boilers in the engine room. This was caused by the severe eastern gale lowering the water below the intake pipe which is lowered eight feet below the surface of the water. The lights were not started again until the wind lowered and the water resumed its level sufficiently to cover the intake pipe. The lights were out for several hours.—Brockville, Ont., Times.

For some time past Lindsay, Ont., has been trying to secure a cheap electric power. Culverwell & White-Fraser of Toronto undertook to form a company and transmit the power from Fenelon Falls to Lindsay, but were unable to make the financial arrangements necessary to the undertaking. The matter has been taken up by some of the citizens with A. E. Ames of Toronto. An electrical expert is to be employed to look into the matter, and if it is endorsed by him and a certain amount of stock taken by the citizens, Mr. Ames will, it is said, undertake to secure the necessary capital to carry the scheme through.

The Welland Vale Manufacturing Company of St. Catharines has increased its factory buildings, and is making a change in the lighting plant. It has, heretofore, operated a direct current two-wire system, but has decided to keep pace with the times, and is installing a 600 light alternating current two-phase S.K.C. plant, which will operate on the three-wire system, giving them a much cheaper distribution, as well as the benefit of having an inductor type dynamo, which they are satisfied possesses a great many advantages over those of the old type. They are following in the lines of the Penman Mnfg Co., of Paris, and the Cockshutt Plow Co., of Brantford, which have replaced their direct current incandescent plant by inductor type machinery.

The proposal of the directors to increase the capital stock of the Royal Electric Company from $1,500,000 to $1,750,000 by the issuance of 2,500 shares of the nominal value of $100 each, to be offered to the shareholders; and also to effect loans by the issuance of mortgage or hypothecary bonds or debentures to an amount not exceeding in the aggregate, including all bonds at present outstanding, 75 per cent. of the paid-up capital stock, and to bear a rate of interest not exceeding 4 per cent. per annum. was not favorably entertained by the shareholders, of whom the majority seemed to favor the raising of all needed funds by allotting additional stock instead of adding to the bonded debt of the company. It was decided to increase the holding of the Royal Electric Co. in the Chambly Manufacturing Company from $200,000 to $300,000.

The report of Percy Domville, the expert electrician engaged to prepare an estimate of the cost of a civic lighting plant for Hamilton, Ont., has been submitted to the city council. The substance of the report is favorable to the position of those who favor the installation of a civic electric light plant. At present Hamilton pays 25 cents a night, or $91.25 a year, for each arc light. Mr. Domville estimates that with a civic plant it would cost the city only 14.93 cents a night, or $54.55 a year for each arc light. This estimate includes interest on investment and a liberal allowance for depreciation of plant, and Mr. Domville says his estimate is too high rather than too low. Accordingly it would pay Hamilton to do its own street lighting. The difference between the price paid and the estimated cost of production is about $15,000 a year.

James Ross, vice-president of the Montreal Street Railway Company, who has recently returned from an extended visit to Great Britain, made some interesting remarks upon street railways in Britain and other matters, in the course of an interview with The Montreal Gazette. Mr. Ross observed that while he did not wish to cast any reflections upon the municipal bodies of Great Britain as regards the slow manner in which they moved, yet it was a fact that most of the cities were extremely conservative in the matter of a change from horse or steam to electrical power. The overhead system appeared to be generally accepted, and Liverpool and Glasgow, which had purchased their respective street railway systems, had each from two to three miles in operation. Bristol and Dublin were also to have the trolley. In Birmingham the people were undecided what course to pursue, and they will, Mr. Ross added, probably await results in the other cities. Mr. Ross also stated that all lines of business in Great Britain seemed to be prosperous.

The McGill Applied Science Technical Society listened recently to a paper, written by R. M. Wilson, science, '99, which was a report upon the testing of the electrical generating plant, put in by the Royal Electric Company at Chambly. The river at Chambly has been harnessed and by means of the machinery described by Mr. Wilson will soon send over heavy copper wires, energy equivalent to 11,000 horse-power in the form of high pressure electricity. The transforming of the power of the water into electric current is effected by four generators, and in the testing of these generators Mr. Wilson was engaged. The electrical equipment at present consists of four two-phase generators of 2,000 k.w. capacity each, two 140 k.w. exciters and necessary high and low tension switchboards for same, with wiring. The main part of the paper was taken up with a relation of the methods of testing the machines. So rapid are the strides made in electrical advancement that scarcely two plants are built in the same way, and thus in the setting up of each plant there is a great deal of interest attached to the testing of the machines, the tests showing the results of the new ideas involved.

Marine News.

The steamer "Edna Brydges" ran on a reef and sank on her last trip from Rat Portage to Fort Francis, Ont.

The Montreal Harbor Commissioners have bought a tug from Carrier, Laine & Co., Levis, Que., for $20,482.

The steamer "NorthernBelle" was burned Nov. 7th, about two miles up Byng Inlet, Ont. The cause of fire is unknown.

Kivas Tully, harbor engineer, and C. H. Rust, city engineer, Toronto, have prepared plans for extensive harbor improvements.

J. & A. Allan are building two new steamers, each of which is to be fitted to carry a large quantity of produce in cold chambers, for the cooling of which J. & E. Hall, Dartford, England, are supplying the machinery.

The new steamer "Toronto," of the Richelieu and Ontario Navigation Company's fleet, has been given its trial trip last month. The boat was out three hours, and was in charge of Captain William Boyd, and everything ran smoothly both in the machinery and general management. The chief engineer is W. A. Black. Among those present were J. Kerr Osborne of the Richelieu Company; George H. Bertram, M.P., president of the Bertram Company; John Bertram, vice-president; A. Angstrom, manager.

We are informed that J. & E. Hall, Ltd., have no less than seventy refrigerating machines to be fitted on board ship at the present time, which comprise machines for the British Admiralty and foreign Governments, the White Star Line, Hamburg-American Steam Packet Company, and many others of the most important steamship companies.

The new Government steamer now being built at Dundee, Scotland, for service between Prince Edward Island and the mainland, to replace the "Stanley," will cost $185,000. Its tonnage is about 1,200 with 2,900 horse-power. It will be provided with a strong protected stern for breaking ice, and its rudder will also be protected by a stee ice cutter.

Lieut.-Col. Anderson, chief engineer of the Dominion Department of Marine and Fisheries, has reported the result of his examination of the ship channel between Montreal and Quebec, in which a number of steamers have recently grounded. He says the opinion is freely expressed that a good deal of the trouble in the navigation of the river arose from the ignorance of some of the pilots.

The importation of beef to England from America is still on the increase. Two fine steamers building for the Atlantic Transport Company by Messrs. Harland & Wolff are to be equipped with a complete installation of refrigeration on J. and E. Hall's Carbonic Anhydride System, the machine being situated in the main engine room in both cases, which arrangement reduces the staff as compared with a separate engine room necessitated by some systems.

J. B. Coyle, manager of the International Steamship Co., died at his residence in Portland, Maine, recently, after a protracted illness. Mr. Coyle had been associated with the steamship business for many years, and was a long time chief engineer of the International Line, but became president and manager of the company about ten years ago. Some time ago he resigned the presidency but retained the position of manager. He had been manager of the Portland Steam Packet Company and the Maine Steamship Company.

By the contract between the Dominion Government and the Allan Line and Dominion Steamship Lines for the winter service between St. John and Liverpool, the first boat left Liverpool on the 12th ult. The first sailed from St. John on the 30th. For the first five weeks the sailings will be weekly from Liverpool on each Saturday. After that they will be on Thursdays. From this side, the sailing will on Wednesdays, unless other arrangements are made later on. The boats to be employed are the "Parisian," "Numidian," "Californian," "Labrador," "Vancouver" and "Scotsman."

Property owners along the river front at Amherstburg, Ont., are clashing with the United States Government over the lime kiln crossing dredging operations. Dredges have been for some time at work widening the channel by blasting and dredging from the Canadian bank. Heretofore the work has been going on above Amherstburg. Recently, however, a dredge under Captain Rooney, began work directly opposite the town. The property owners along the bank of the river immediately served notice on the captain to cease the work. They claimed that under the Crown patents the title of property extends to the bank of the channel. Therefore, in blasting away the bank they argue that the United States is stealing their property. Captain Rooney paid no attention to the protest.

It has been announced that one of the principal steamship lines running to the St. Lawrence is prepared to establish its terminus at Quebec on the basis of an exemption from all harbor dues for a term of five years. This information has been conveyed by a letter from the Hon. P. Garneau, president of the Great Northern Railway, to the chairman of the Quebec Harbor Commission, which states that the company in question is ready to negotiate with Quebec whenever it is prepared to close a contract on those terms, and to run a regular line of steamers between Quebec and Liverpool, loading the freight brought over the Great Northern and Parry Sound Railways to Quebec.

Work is progressing very satisfactorily on W. Davis & Sons' contract on the St. Lawrence Canal at Cardinal. It is the largest cut for the area of any canal on the continent, there being almost two million yards of excavation. The length from the point where it leaves the old canal below the town to where it re-enters above is one and one-third miles. There are four steam shovels, nine locomotives, a large number of horses and from six to seven hundred men employed. The contractors operate about fifteen miles of tracks and are dumping the earth two and one-half miles below the cut. The locomotives are averaging about twenty-eight trips every twenty-four hours and the Starch Works Company supply electric light from end to end, so that the work of excavation goes on all night.

Personal.

Henry Weston, Montreal, has been appointed managing foreman of the C P.R. workshops at Perth, Ont.

G. Whittaker, Toronto, has been appointed second assistant superintendent of the street railway, London, Ont.

F. A. Wunder, New York manager of the Fort Wayne Electric Corporation, of Fort Wayne, Ind., was in Toronto recently.

Newton J. Kerr, an assistant in the city engineer's office, Toronto, has accepted the position of assistant city engineer, Ottawa.

Jno. Milne, head of the stove manufacturing firm of Burrow, Stewart & Milne, Hamilton, Ont., fell and broke his leg last month while walking home from his office.

John Kerr, the motorman on the Toronto Railway who was injured in a collision last summer, is suing the Street Railway Company for $7,500.

Sir John Fowler, who was engineer-in-chief of the Forth bridge, for which services he was a created a baronet in 1890, is dead. He was born in 1817.

C. G. Rothwell, assistant last session to Professor De Kalb, Kingston, Ont., School of Mining, has been appointed assistant manager of El Concheno mine, Chihuahua, Mexico.

R. S. Logan, Montreal, assistant to Chas. M. Hays, general manager of the Grand Trunk Railway System, was married at St. Louis, Mo., last month, to Miss Annie Rankin.

F. W. Dawson, engineer for the Indian Government at Bombay, has been in Canada recently looking over the Canadian system of canals for the information of his Government.

The employees of the New Vancouver Coal Co., Nanaimo, B.C., recently gave a dinner to Thos. Morgan, the new coal mines inspector for British Columbia. Wm. McGregor, superintendent of the mine, was in the chair.

R. G. McConnell, of the Geological Survey, has returned to Ottawa from the Klondyke and left for the East. He traveled a good portion of the Yukon and will make an extended report to the Department of the Interior.

Wm. Findlater, of the firm of Bannerman & Findlater, Elgin st., Ottawa, Ont., died a short time ago, after a brief illness. Deceased was 37 years of age, and was a cousin to the hero of Dargai Ridge. He leaves three orphan children.

Hartley Gisborne, M. Can. Soc. C.E., electrical engineer, formerly of Toronto, now of Winnipeg, has been appointed by the council of the Institution of Electrical Engineers, London, England, their local hon. secretary and treasurer for Canada.

The wedding of Collingwood Schreiber, Deputy Minister of Railways and Canals, to Miss Gwynne, daughter of Judge Gwynne, of the Supreme Court, took place November 14th at Grace Church, Ottawa. The wedding was private, only near relatives being invited.

We regret to announce the death of Matthew Cooper, foreman of the Canadian General Electric Company, which occurred at Peterboro recently. Mr. Cooper was for some years foreman of the Edison Electrical Works, Hamilton. He leaves a widow and six children.

Dr. S. A. Mitchell, son of John C. Mitchell, contractor, Kingston, Ont., has been appointed research assistant at the Yerkes Observatory in connection with Chicago University. He is a graduate of Queen's University, Kingston, with the degree of M.A. He also has the degree of Ph.D. from Johns Hopkins University, Baltimore.

Robert Hobson, secretary of the Hamilton Blast Furnace Company, met with a painful accident a short time ago. He had ridden up on a coke train from the smelting works to the Radial line, intending to take a car to the city. As he started to jump from the coke car one foot caught in the ledge and he fell to the ground, breaking his leg just below the knee. He was brought to the city on a Radial car and removed to his home.

W. S. Buckland, Montreal, has received the pleasing information that his son, who had served some time in the C.P.R. shops in Montreal, had, while in England, passed his examination for the Royal Navy, and received the appointment of engine-room artificer, which makes him a first-class petty officer. He had to compete against Old Country boys, and it speaks well for Canadian training when it is known that he took seventy-five per cent. of the marks.

F. S. Rathbun, one of the active partners and treasurer of the Rathbun Company, Deseronto, died suddenly while dressing on the morning of Nov. 26th He appeared in the best of health and spirits on going to bed the night before at his usual time, and got up at his usual time, and went into his dressing-room, where, without any warning, he suddenly expired. He had lived all his life at Deseronto, and had taken a deep interest in, and done much to advance the commercial prosperity of the town. The news will be received with deep regret among his wide circle of friends, by whom he was very much liked and appreciated. Besides his active participation in the work of the Rathbun Company, he had interested himself in many of the commercial enterprises, railway and steamboat connections that have contributed to make Deseronto what it is.

The Kilmarnock Standard (Scotland), on the occasion of the laying of the foundation of stone of The Dick Institute, Public Library and Museum, presented to his native town by James Dick, at a cost of £11,000, refers in an interesting column of "personal notes" to the great success which attended all business enterprises in which the Dick brothers engaged; commencing with the adoption of gutta percha in the manufacture of boots, which for thirty years was their staple manufacture. Then, in 1870 they began to consider the capabilities of balata, a species of India rubber for strengthening cotton for belts, which became immediately successful for all kinds of machinery. Twelve years ago, on the occasion of his marriage, James Dick presented to the people of Glasgow the Cathkin Park, a gift that cost about £50,000. While on his bridal tour, which included a visit to Melbourne, Australia, the discovery of the Broken Hill Silver mine was brought to his notice, and he bought a seventh share of the whole mine, and sailed away. While he was on the sea his seventh share became a fortune. On his return, his brother Robert having died while he was away, he had to assume the proprietorship and management of the Greenhead works. Unexpected success attended him. The balata belts were found to be the best for machinery, especially in the deep shafts of gold mines in Johannesburg and other places. On one of his many journeys he secured a large interest in the Mount Morgan mine, which in itself would make him one of the wealthiest men in Scotland.

LITERARY NOTES.

We have received the annual reports of the city engineers of St. Louis, Mo.; St. John, N.B., and Toronto, Ont., whose contents are referred to in other parts of this issue.

The well-known "Hawkins'" books for engineers, firemen, electricians, superintendents and all steam users, are attracting a great deal of favorable notice from the reading public.

The Aikenhead Hardware Co., 6 Adelaide street east, Toronto, has issued a pamphlet describing the Pasteur Filter, under the title, Drinkable Water and its Hygienic Value in Health and Epidemic Diseases.

We are in receipt of a catalogue of the Standard Tool Co., Cleveland, U.S., which manufactures electrically welded bicycle parts, etc., which gives some interesting information about this line of the company's output.

The Scientific American Hand Book on Patents, Caveats, Designs and Trade Marks, published by Munn & Co., New York, contains valuable and useful information for the inventor who intends to protect in the United States the product of his genius.

The National Association of Master Plumbers, Gas, Steam and Hot Water Fitters, of Canada, has begun the publication of a monthly magazine, "The Official Bulletin," whose first number appeared last month. We take pleasure in welcoming the new journal to our table.

"Steam" is a handsome cloth bound volume of 130 pages, of which every one contains something an engineer wants to know. It may be had free by sending your address to the Babcock & Wilcox Co., 202 St. James street, Montreal. The illustrations are very numerous and show many of the finest and most famous buildings on the continent.

The proceedings of The Association of the Ontario Land Surveyors at its sixth annual meeting since incorporation have just been issued. The meeting was held Feb. 22nd and March 8th, 9th and 10th, 1898 and was well attended by the members as was reported in The Canadian Engineer for April. The report makes a volume of over 258 pages. The seventh meeting of The Association of Ontario Land Surveyors will be held in Toronto, beginning February 28th, 1899.

The Tidal Survey Branch of the Department of Marine and Fisheries of the Dominion of Canada has issued the Tidal Tables for Halifax, Quebec and St. John, N.B., for the year 1899, with tidal differences for the Atlantic coast of Nova Scotia, and for the St. Lawrence River, from Three Rivers to Gaspe. The tables are reprinted from Greenwood's Nautical Almanac and Tide Tables for 1899.

The eleventh edition of Lovell's Business Directory of Montreal has been prepared with the care and completeness which characterizes the works of reference issued by this well known firm. The present edition comprises a classified business directory with a general index to the classification, a guide to the streets of the city, and a large body of miscellaneous information, including the customs tariff.

The Year Book of Canada for 1897 has been issued from the Department of Agriculture, Ottawa, and contains the usual mass of statistics relating to every department of trade, commerce, finance, etc., of the Dominion. The compiler, Geo. Johnson, F.R.S.S., now ranks among the highest statistical authorities of the British Empire, and the present volume sustains his well-earned reputation.

The "Practical Engineer" Pocket Book, 1899, is a neat, strongly bound volume of convenient size; leather with gilt edges. There are over 400 pages of valuable matter clearly expressed and brought into small compass. There is a combined memorandum book and calendar included in the volume which is a most convenient feature. The "Practical Engineer" Pocket Book, the Technical Publishing Co., Ltd., Manchester, England.

We have received "Sewerage and Sewage Disposal," by Henry Robinson, M. Inst. C.E., Fellow of Kings' College, London; Professor of Civil Engineering, King's College, London, etc., etc., which is a very substantial volume of about 200 pages, published by E. & F. N. Spon, 125 Strand, London. The tabulated statistics are very valuable and comprehensive. The American trap system is unsparingly condemned on page 16. Though the American system is not explicitly mentioned; the advocacy of the free ventilation system described in The Canadian Engineer is very strong.

It was in the year 1847 that the first issue of the Canadian Almanac was published, and every year since it has made its appearance. Among the contents of the book which are especially valuable are: The Customs Tariff, Postoffice Guide, and Directories of various persons and officials, all of which are brought up to date, while the articles on the British Army and Navy and Forms of Government throughout the world are interesting and reliable. A feature that appeals particularly to all who are interested in the current history of the world is the Historical Diary, which is carefully prepared each year, and gives an excellent resume of the year's history. The publishers are to be congratulated upon the appearance of the 52nd issue of the Canadian Almanac. Price, 25 cents. The Copp, Clark Co., Limited, Toronto.

"Steam Navigation and its Relation to the Commerce of Canada and the United States," is the title of a very interesting volume by James Croil, of Montreal, published by William Briggs, Toronto, and produced with the usual typographical excellence of books issued by the Methodist Book Room. Mr. Croil is already known by his "Dundas; a Sketch of Canadian History," published a good many years ago, and now out of print. The present volume is the result of much painstaking labor, and traces the history of steam navigation from the beginning down to the past year or two. Most of our readers already know that the first vessel to cross the Atlantic entirely by steam was one of Canadian design and workmanship, namely, the Royal William. This vessel, by the way, was not only the first commercial steamship, but became the first steam man-of-war, as after being for some years in the Anglo-American trade, she was sold to the Spanish Government, and then to the Portuguese Government, who had her converted into a gun boat, propelled by steam. The author gives a very full account of the Royal William, whose achievements were considered worthy of the following tablet in the Canadian House of Commons: "In honor of the men by whose enterprise, courage and skill, the Royal William, the first vessel to cross the Atlantic by steam power, was wholly constructed in Canada, and navigated to England in 1833." Mr. Croil refers to the fact that the Molsons, who were prominent in the first development of steam navigation on the St. Lawrence, failed to get a monopoly of steam traffic in Lower Canada as Fulton had done in New York. It may be interesting here to recall the fact, not generally known, that Louis Papineau, the agitator, was among those who voted for this monopoly. The record of navigation on the Upper Lakes is rather deficient, but when allowance is made for this, the work is a most valuable history of steam navigation in Canada, while a good deal of general historical matter on the development of steam navigation throughout the world is brought under the reader's view. The volume contains 381 pages and about 100 illustrations.

The Rev. Chas. M. Sheldon's books, now so universally read, make it plain that that writer's hopes of the regeneration of the world lie in getting individuals more and more to do their daily tasks on Christian principles no matter what the sacrifice involved. In the best known of his books, "In His Steps," he clearly looks to the newspaper, carried on upon Christian principles, as largely the hope of the "coming kingdom." In looking about him for a newspaper upon his model, he seems to have hit on The Montreal Witness, to which he has addressed a letter, part of which we quote: "I have read The Witness with much interest. I cannot say that I know of any other daily paper in the United States that is conducted on such high Christian principles. I wish I did, for if ever we needed such a paper in our country we need it now. Let me express to you my appreciation of the Christian heroism and consideration which make a paper like The Witness a possibility. I have always believed it possible for a Christian daily to succeed. You have proved that it can. So much of the ideal newspaper in 'In His Steps,' is therefore real. I pray that you may continue to be blessed in your work. I do not know a more glorious opportunity for building up the kingdom on earth than by means of Christian journalism. I take the greatest pleasure in sending the copies of The Witness to newspaper friends of mine for their inspection. Charles M. Sheldon."

—Of nails, the imports into Japan from the United States increased from 3,260,858 katties in the first half of last year, to 7,494,197 katties in the first half of the present year—the katty being about 1.3 pounds; the total importations of nails had fallen meanwhile from 10,394,717 katties in the first half of last year to 8,754,035 in the first half of the present year.

METAL IMPORTS FROM GREAT BRITAIN.

The following are the sterling values of the imports of interest to the metal trades from Great Britain during October and the ten months ending October, 1897, 1898 :—

	Month of October.		Ten months ending October.	
	1897.	1898.	1897.	1898.
Hardware	£7,921	£2,039	£58,593	£22,042
Cutlery	..	5,163	..	45,414
Pig iron	1,187	1,474	6,435	9,879
Bar, etc.	306	1,856	7,878	10,156
Railroad	6,885	..	45,778	25,154
Hoops, sheets, etc.	15,307	7,571	71,261	52,382
Galvanized sheets	13,439	11,034	49,986	55,286
Tin plates	30,122	19,843	162 971	123,882
Cast, wrought, etc., iron	2,932	4,196	28,889	28,653
Old (for re-manufacture)	1,292	..	6,483	3,574
Steel	6,440	3,696	47,501	43,430
Lead	4,888	7,360	23,950	32,025
Tin, unwrought	1,169	1,727	14,987	15,407
Alkali	8,767	10,440	34,849	42,475
Cement	2,880	5,835	18,491	23,762

—The Knowles, Ham & Nott Company are about to make extensive additions to their spring bed factory, Brantford, Ont., and the Brantford Starch Company are now putting another storey to their building in order to meet the increasing demands of their business.

—The Kirk-Latty Manufacturing Company, of Cleveland, manufacturers of tacks, trunk cloth and small nails, are talking of locating in London, Ont. The Mann Manufacturing Company, of Brockville, Ont., farm implement makers, have also communicated with the Council regarding inducements to locate a branch of their business there.