Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☐ Coloured covers/ Couverture de couleur
- ☐ Covers damaged/ Couverture endommagée
- ☐ Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/ Le titre de couverture manque
- ☐ Coloured maps/ Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- ☐ Coloured pages/ Pages de couleur
- ☐ Pages damaged/ Pages endommagées
- ☐ Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- ☑ Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- ☐ Pages detached/ Pages détachées
- ☑ Showthrough/ Transparence
- ☐ Quality of print varies/ Qualité inégale de l'impression
- ☑ Bound with other material/ Relié avec d'autres documents
- ☑ Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- ☑ Continuous pagination/ Pagination continue
- ☐ Includes index(es)/ Comprend un (des) index

Title on header taken from:/ Le titre de l'en-tête provient:

- ☐ Title page of issue/ Page de titre de la livraison
- ☐ Caption of issue/ Titre de départ de la livraison
- ☐ Masthead/ Générique (périodiques) de la livraison
- ☐ Additional comments:/ Commentaires supplémentaires:

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

| 10X | 12X | 14X | 16X | 18X | 20X | 22X | 24X | 26X | 28X | 30X | 32X |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | ✓ | |

# The Canadian Engineer

VOL. V.—No. 7. TORONTO AND MONTREAL, NOVEMBER, 1897. {PRICE, 10 CENTS $1.00 PER YEAR.

## The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, ELECTRICAL, LOCOMOTIVE, STATIONARY MARINE, MINING AND SANITARY ENGINEER; THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

SUBSCRIPTION—Canada and the United States, $1.00 per year; Great Britain and foreign, 6s. Advertising rates on application.

OFFICES—62 Church Street, Toronto; and Fraser Building, Montreal.

BIGGAR, SAMUEL & CO., Publishers,

E. B. BIGGAR — Address—Fraser Building,

R. R. SAMUEL — MONTREAL, QUE.

Toronto Telephone, 1892. Montreal Telephone, 2589.

**All business correspondence should be addressed to our Montreal office. Editorial matter, cuts, electros and drawings should be addressed to the Toronto Office, and should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 1st of each month to ensure insertion.**

## CONTENTS OF THIS NUMBER:



For THE CANADIAN ENGINEER.

## RAILWAY ENGINEERING.*

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

### CHAPTER IV.

### ARTICLE 11.—SURVEYS.

The final determination of the exact centre line of a railway roadbed and track is only reached after a process of sifting, which extends from the first thought of the necessity for such a railway until the track is laid. Roughly speaking, it is usual to divide the operations into three stages, which, however, often overlap each other, or are again divided into subsidiary steps. These customary general divisions are:

(1) Reconnaissance.
(2) Preliminary or Trial Line Surveys.
(3) Primary and Revising Location Surveys.

### ARTICLE 12.—RECONNAISSANCE.

Reconnaissance may be said to begin after it has been decided that there is a necessity for a railway between two given terminals, or along a given route.

In the latter case, local considerations, or the shortness of the distance, or the existence of a definite water line route, may limit the scope of explorations, but looking to the larger problem, where an engineer has to determine what is the best route between two terminals several hundred miles apart, the study is interesting and one requiring a high order of talent. If the country to be traversed is unsettled, or thinly settled, the problem is simplified by lack of railway competition often, or even by considerations of traffic, but it then demands a close investigation of the natural resources of the country, which, though dormant, will be developed by the railway itself, and it might be considered best, all things considered, to build sometimes, at a sacrifice of distance, grades, or capital outlay, through a country of great natural resources, rather than through a barren one by a route physically superior. On the other hand, through a populous country, the question is much more complex, by reason of the existence of other railway routes already established; but, on the other hand, simplified by a more or less well defined trend of population, which indicates the probable future distribution of people in accordance with natural laws. For these and many other reasons, exploration should commence and be well under way, or even completed, before instrumental work commences; it should, at least, be completed for such a distance that some critical place has been reached through which the final location must pass.

In order to finally fix on the best route between two defined points, it is necessary to study a wide belt of country; even a great number of trial routes will not answer so well, because portions of various routes may be finally selected and joined together. In order to explore such a wide belt of country, use must be made of all existing maps. These when made from governmental surveys will be found of extreme service as a skeleton on which to build such additional information as may be necessary to complete the study in hand. All streams, summits, passes, etc., within the extreme margin of possible routes should be accurately fixed in plan and elevation. A knowledge of the classes of timber, stone, and excavations, and of difficult river crossings, etc., should be included, and from such data, together with closely estimated lengths of lines, ruling grades (obtained from barometer heights), probable traffic, cost of construction, difficulties of maintenance and dangers of future or present competition. A selection is made of the two or three most favorable routes, over which it is thought necessary to make instrumental surveys.

In carrying out reconnaissance, the instruments required will depend on the class of work to be done. These should always include an aneroid barometer, a Locke level, a pocket or prismatic compass and a field glass; distances may be determined from maps, if existing, by pacing, by the rate of travel of a horse, or if in open country, it will be better to take the time to determine them by stadia or some form of telemeter. The aneroid barometer is an instrument supposably compensated for temperature, and under static air pressures capable of always reading the same at the same altitude; but errors in graduation, in workmanship and adjustment, and the barometric changes going on in the atmosphere make it far from a precise instrument. In order to make it available, each instrument when purchased should be rated alongside a mercury barometer, and only those

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

which have a reasonably uniform and small rate of error should be accepted, so that a table of such errors can be prepared and used in conjunction with actual readings taken. Aneroids in high altitudes are often much in error, and generally speaking, should be used to obtain *differences* in elevation rather than actual ones. If a barometer is read at the same spot every hour for a day, a continual fluctuation will be noticed, even during bright dry weather and very much more so during periods of storm or change; these readings if plotted may be termed the *diurnal gradient*. It is evident, therefore, that readings from an aneroid taken at various places, at different times, even during the same day, will not be reliable, and in order to make such readings of value, there should be another stationary aneroid read at regular intervals, and the readings of the moving aneroids corrected according to the fluctuations observed at the central point. Should only one aneroid be available, it would be better, where possible, to make two or more determinations of the same points at different times, to get an average, and to work only when the atmosphere is in a settled condition. Equipped with the above-mentioned instruments and one or two assistants, the engineer on reconnaissance should go into the field free from prejudice; the well-known wagon road or trail may be very convenient to travel along, but not necessarily in the vicinity of the best railway location; the river flowing between or in direction of the termini may have precipitous, treacherous banks, be crooked in alignment, and afford not nearly so feasible a route as the upland country adjacent; just beyond a certain forbidding range of hills may lie a direct and cheap route, and a pass through the barrier may really exist, being hid in the distance by an overlap. In fact, the frame of mind suitable for such an undertaking should be optimistic, ready to believe that if only time enough is available, the best route can be found, but at each moment doubting that such a route is yet discovered.

In addition to those general economic considerations which have been touched on in previous chapters, it is well to remember, amongst other things,

(*a*) That lines following large streams will usually require heavy bridge work and masonry in crossing tributaries.

(*b*) That one bank of a river may be much better than the other, and that it may even pay to cross the river at rare intervals to secure alternately favorable stretches of construction.

(*c*) That lines on side hills are more costly to maintain than those through level country, owing to the sliding and washing that takes place.

(*d*) On the other hand, that a cross-country line, usually, will cross many summits, and even when skilfully located, and often at a considerable loss in distance, will abound in curvature and maximum grades.

(*e*) That in each locality will be met men who have an intimate knowledge of the minutiæ of the surrounding country. Many of these look on themselves as born locating engineers, and while their ideas on grades and curves are usually misty, every shrewd engineer will not be averse to the valuable aid which such men voluntarily offer; the only difficulty lies in sifting the wheat from the chaff without giving personal offense.

(*f*) That the engineer of reconnaissance and afterwards of surveys is the first officer of the railway company to be thrown in contact with the people who are to become the future patrons of the road, and, as such, his manifest duty is to make as many friends for his company as he can, consistently with his other duties, and enlist their sympathies in its favor; in this way a much more reasonable spirit will be created which will display itself when right-of-way questions begin to arise.

After a complete study of the intervening country has taken place, a rough sketch map should be made from the notes taken, and other existing ones, on which will be shown the positions of all streams, summits, etc., with elevations marked at critical points, then possible routes will be indicated, calculations made of the length of lines, maximum grades, probable amounts of curvature, approximate cost of constructions, present and future traffics, etc., all of which, although much in error, will usually narrow down the question to two or three routes which are selected as the most likely and suitable ones for instrumental surveys.

### Article 13.—Preliminary or Trial Line Surveys.

The roughest class of preliminary survey may be an amplification of reconnaissance, in which a small party of three or four men pass rapidly over several proposed routes at a rate of five to fifteen miles per day to determine what grades can be obtained before more accurate survey begins. In open country rapid progress can be made, using stadia for distances and using vertical angles for elevation or depression, which are checked by an aneroid barometer. In a wooded country the distances will be determined more rapidly by chain and compass, and heights by aneroid. Side slopes may be noted at difficult spots by some form of clinometer. What is usually wanted is to know what grades can be obtained at certain critical points, in order to adopt a ruling grade for the route. The instruments required are a light transit with stadia hairs, compass and vertical arc, a stadia rod, an aneroid barometer, a clinometer, a 100 ft. steel chain and 50 ft. linen tape. On this class of work the error of stadia measurement should not be more than 1 in 1,000, which is more accurate than rough chaining. When a full survey party for instrumental work is to be equipped, a variety of causes tend to determine the men and instruments required.

(*a*) In an open rolling country. If contour lines are not needed, the party will usually consist of—

| | |
|---|---|
| Chief of party,<br>Transitman,<br>Leveller. | Engineers, preferably all experienced. |
| Rodman,<br>Front Picketman,<br>2 Chainmen. | Active young men, preferably educated college graduates, not afraid of work. |
| 2 Axemen,<br>1 Stakeman. | Seasoned workingmen, used to bush life, axes, and hard work. |

If under canvas, add one cook and one assistant cook, and in this kind of country always use a transit.

(*b*) In thickly wooded country, without iron ore, better results, for the same labor, will be obtained by using a 12-inch to 16-inch compass, instead of a transit, avoiding many detentions, useless cutting of trees, etc. The compass has no cumulative error, and will give good results where no contours are taken; if contours are to be taken, it is better to establish transit line for future use. In a wooded country two or three extra axemen will be needed to make rapid headway; the front picketman also, in this case, should be an expert axeman, and lead the others.

(*c*) If the country is much on side-hill, another party is needed in addition to the transit and level parties, whose duty it is to take contours. In the past contouring has often been omitted, and although there have been some men of great natural talent and long experience who have been able to locate well, even through very rough side-hill country, by eye alone, yet even to such men a properly conducted contour survey would have been of great advan-

tage. It is becoming more fully realized every day that a contour map, with a location line laid on it in the office and revised afterwards, where necessary, in the field, is a very valuable part of preliminary surveys in such a kind of country. This topography party consists of two or three men, equipped with a level board, level rod and hand level, or else with a clinometer and tape to measure side slopes; the work is carried on one day behind the level party, and the method of procedure is somewhat thus:

Detached sheets of paper about 18 inches by 24 inches, have plotted on them the centre line and level height at each 100 feet and hub, according to the previous day's records; these sheets are mounted on a drawing board and taken into the fields, where 5 feet or 10 feet contours are plotted and sketched direct, for a distance of 20 to 50 feet in elevation, up and down hill from the centre line, depending on evident requirements; with a little practice, the distance to each contour can be taken and plotted very rapidly, obviating the necessity of notes. Intermediate irregularities, etc., can be also sketched in by eye, and the sheets when taken back to the office can be placed in proper alignment and chainage, and a tracing taken if necessary; but probably the projected location line will be at once placed on these sheets and then transferred to the field at once, or by another party following, or the whole matter may be held over until a decision is arrived at as to the correct location route to adopt; this will evidently vary with each case. If the contour notes are recorded in books in the field, they may be plotted on a continuous roll in the office; but such a method is more tedious, and little irregularities which would be sketched in the field are often omitted in notes. A topography party relieves the transitman of all note-taking except centre alignment, whereas all notes of natural and artificial topography are taken by the transitman where no topography party is employed, thereby delaying the progress of the whole survey. A topographer should preferably be a Provincial Land Surveyor also, so that his work in recording land lines and making plans may at once be legalized.

The qualifications and duties of the members of a survey party are somewhat as follows:

*The Chief of Party* should be a man of vigorous mental and physical attainments, familiar with the details of survey life and minutiæ, with a wide experience of construction, and even, if possible, of maintenance of railways, well informed on such matters as have been touched on in previous chapters, and capable of commanding prompt obedience and zealous assistance on the part of every member of the party. If, in addition, a man can be found who has also a natural genius for railway location, he cannot be too highly treasured or paid. The chief of a survey party is the most important position in the pay of a railway company where location is of a difficult and perplexing nature. Crippled constitutions and receiverships are more often the result of poor location than from any other cause, hence the high value of the men who decide on such matters. A chief may be a strict disciplinarian and still command the regard of his assistants; he should have free scope to dismiss anyone not competent and willing to do good work; and should never do any work for subordinates, except in the rarest instance, but should be well on at the front most of the time, devising the next step before it is needed, and having in view a general plan of the country, not looking straight ahead, but feeling that just "beyond" there may be a better line. The rate of progress is fixed by those at the front, the others must keep up. A chief of party carries usually a pocket note book, or even topography book, an aneroid barometer and a pocket compass.

*The Transitman* should be an engineer of some experience, particularly in handling men, keeping full and accurate notes, and rapid and yet delicate handling of his transit. He should be alive to the general movement of the men in his party, which means that he should not always be looking through his telescope at them, but commanding their movements directly also, and above all, he should put his transit in position quickly, and not keep a whole party waiting while he dawdles over his levelling screws, etc. Where there is no topographer, the transitman, in addition to keeping notes of the survey alignment, must sketch neatly, with necessary measurements, all buildings, roads, farm lines, etc., in fact all artificial and natural topography, and obtain all owners' and tenants' names. In a level country, topography should extend for at least 500 to 1,000 feet on each side of the line, as the location may be moved that much, and thereby run through houses and barns that have not been noted. This should be done where necessary by accurate chainage offsets. In country of steep side inclinations this is not necessary; judgment will determine the width of the topography belt needed in each instance.

*The Leveller* may be a young engineer of limited experience, although preferably one capable of rising rapidly to higher position, and not one whose engineering horizon is bounded by such work. In addition to centre line levels, taken at each 100 feet station, hub, and intermediate change of vertical direction, the leveller notes the wooded and cleared portions, the class of timber, probable nature of material in cuttings and borrows; the depth, volume of flow and high water mark of all streams, and establishes bench marks, at say each half mile on preliminary surveys.

*The Level Rodman and Chainmen* should not only be instructed how to do their work, but day after day should be made to chain and hold their rods correctly; chains should be tested frequently. It is certain that more errors are due to poor chaining and rodding, to insecure hubs, and to slovenly work amongst subordinates, generally, than to poor instrumental work, although the blame for such errors is usually laid on the latter.

*A Front Picketman* is invaluable and should be distinct from the chainmen; he should be an active, intelligent man, one who can select a transit site with judgment, make and drive a hub well, take centre, make and drive reference stakes, make a cross-head for back-sight, and then, after placing his picket *exactly* on line, or laying it on the ground, continue to make stakes until the transitman arrives, or better still, if so directed, he may continue to the next site and be ready by the time the transit is placed, to take hub again. In cleared country, hubs should be driven in secluded spots along fence lines, etc., wherever possible, or else in a few months all traces of line across cultivated fields will be obliterated. If hubs come, necessarily, in open places, extra ones should be put in in sheltered spots. If the line is being carried through forest, the same care will not be necessary to preserve the line, and transit sites will depend more on natural profile; in this case the front picketman should be continually taking line for clearing, and leading, and commanding the axemen, being himself also, for the time, an axeman. In general, it is best to not have a back picketman; but have the transitman place a cross-head on line within a few inches of his transit telescope just before moving forward. If a back picketman is employed, it is best to still use a cross-head and keep the man merely as a guard and

handyman for occasional use in emergencies ; a cross-head is very accurate and never falls asleep at inopportune moments.

During survey, people naturally resent injury to crops and premises, even when the least possible is inflicted, and polite words and sincere endeavors to minimize the loss are rightful and expedient. Many survey parties constitute themselves armies of invasion ; trees are needlessly cut down, growing grain trampled on, fences torn down to make stakes, and a general tone of overruling ruthless power is prevalent, all of which is wrong and foolish. Many life-long enemies to the road have been made in just this way, and the probable immediate consequences will be that all stakes will be torn up and thrown aside as soon as the party has passed by, and, in addition, the purchase of right of way will be made needlessly difficult and expensive ; the far-reaching consequences to a railway company of the actions of survey parties in this respect are beyond calculation.

After preliminary surveys are completed, and it is desired to obtain approximate estimates of the quantities and cost of construction for a comparison of routes, various short-cuts are used. Excavation tables can be purchased or made for taking out quantities of earthwork. General plans of trestles, culverts, etc., can be used, and tables drawn up of the cost per lineal foot for various sizes and heights, but the larger structures will each require special calculations. In taking out approximate quantities, remember—

(*a*) That embankments require more than cross-section measurements indicate, by about 5 per cent. if of sand, 10 to 12 per cent. if of clay, and 15 to 25 per cent. if of loam or peat, but that rock expands 25 to 75 per cent., depending on the size of the rocks. This shrinkage will not take place fully for a year or two, and may not exist at all during hurried construction, and will be made up afterwards by train.

(*b*) That unless the depths of foundations are known, a liberal allowance should be made for possible deep ones.

(*c*) That side-hill quantities are not indicated by the centre line profile and should be specially provided for.

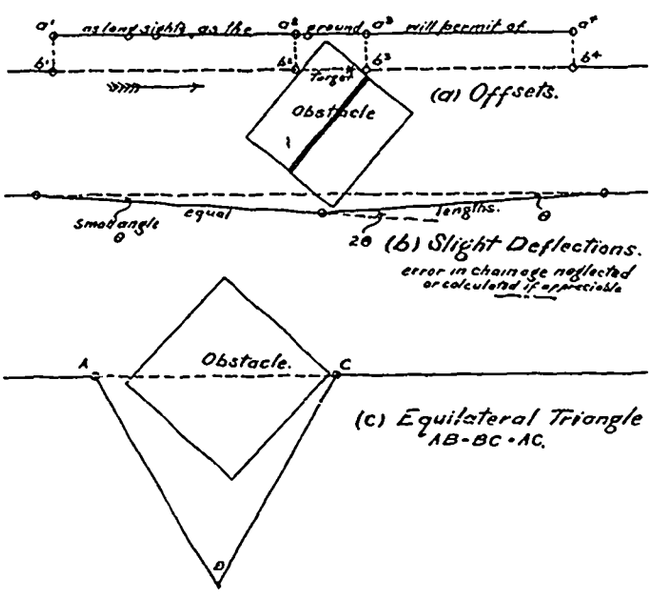
(*d*) That the classification of material is likely to be higher than surface indications would seem to warrant.

### Article 14.—Location Surveys.

The duties of each engineer of a survey party are considerably increased when the location of the selected preliminary line is decided on. The chief and transitman note the foundations for all structures, and should be given time and facilities to have soundings of the beds of the streams, etc., made, so as to determine the depth of foundations quite accurately. This may be made a part of the leveller's duties, if he has more time for it. They should carefully note the natural resources of the country passed through, whether good quarries and ballast pits exist or not; whether timber suitable for trestles, piles, or ties is available, and the probable traffic on various intersecting highways, so as to determine at each one whether it will justify the company in expenditure sufficient to pass the road over or under the railway. In fact every item of information necessary for a complete knowledge of each structure, etc., so as to be able to say definitely what structure is best at each point and why. If the topographer is not a land surveyor it will now be necessary to add one to the party, whose duty it will be to fix the exact position and angle of crossing of each property line, and measurements to nearest monuments, the bearings being taken by compass. Also to obtain the full names of all owners and tenants whose properties are to be affected, the exact positions of all buildings or highways within 400 or 500 feet of the centre line, and all prominent natural topography. The leveller, in addition to those duties already noted for preliminary work, will need to establish and witness bench marks about every 1,000 feet, not closer than 30 feet or 40 feet to the centre line, nor more than 50 feet or 55 feet in a bush country, while in an open country any convenient distance laterally will answer. Very few places should be deemed suitable for a bench mark ; the root of a large green stump, or the top of a small one, cut off for the purpose, is the best. If the root of a tree is used it will grow a little in the course of years ; it is liable to be invalidated by the wind blowing the tree over, or lifting the roots in loose soils, and worst of all, if on the right of way it is liable to be burnt up or cut down below the blaze made on the side of the trunk for reference, thereby being lost entirely. Bench marks should be selected at elevations close to structures, but otherwise at heights nearly that of the proposed grade line, so as to be convenient in running grades, ballast heights, etc. When a located line is laid down without much revision, it will, in any difficult

Fig. 19.

*Methods of producing a straight line past an obstacle*




country, pay by many times the expenses of a survey party, to revise the whole line, when numerous small changes will be made from point to point.

In finally staking such a revised line, it should be thoroughly done, and hubs and stakes stout and well driven, good strong nails (1-inch tinned) used. No hub should project more than half an inch above the ground, and in a settled country stakes should be bought at a sawmill and carried along a day at a time ; the using of fence rails for stake material creates more ill-feeling than the trifling economy warrants. Unless construction is imminent, all hubs should be referenced by cross lines or otherwise. Nothing is much more disheartening to the constructing engineer than to find a located line almost obliterated and untraceable. There are three general methods of prolonging a straight line beyond an obstacle.

(*a*) By offsets, where the necessary offset is not very long; this is the most accurate method. The measurements $a_1b_1$, $a_2b_2$, $a_3b_3$, $a_4b_4$ are identical and made very carefully with a steel tape and plumb line; the transit sites would be at $b^1$, $a^2$, $b^4$, with a target placed on top of the obstacle, if possible, as a back sight check. (See fig. 19.

(*b*) By making a slight angular deflection measuring a certain distance until just opposite the obstacle, then deflecting back twice, the first deflection measuring an equal distance and then deflecting again on to tangent, by an angle equal in amount and direction to the first one, the error in chainage is usually disregarded; this method introduces three angular measurements and is not likely to give an exactly straight line for this reason. (See fig. 19.)

(*c*) By laying out an equilateral triangle, this fixes the chainage beyond the obstacle, and presumably the direction and line; but as this method introduces three angular measurements and two linear ones, it is not apt to give as good results as the first two. (See fig. 19.) It is understood that if by placing a transit on top of a secure obstacle the line can be prolonged directly over it, it is best to do so even at considerable personal inconvenience.

If very accurate transit work is desired, it is not best to trust to the adjustment of the instrument, but take two points on each hub, and use the mean. In the same way, equal backsights and foresights in levelling should be obtained wherever possible, to minimize the result of a level being out of adjustment, and also it is best to adjust instruments for about the distance that the ordinary sights are to be in any given class of country. The travel of the tube in a large change of focus often throws an instrument out of adjustment for very short or very long sights.

It is often found that a survey party, before being disbanded, has time to do cross-sectioning for construction; this is a mistaken economy, and a source of errors and mutual accusations. The members of a survey party do not take interest in work; they are not to superintend, and the cross-sections will probably be poorly chosen and executed. Then the centre line will very likely be altered in various places, which will invalidate all sections at those points. Generally speaking, it is best to have the engineer of construction do everything of an engineering nature which appertains directly to his work.

(*To be continued.*)

## THE PETROLEA WATER WORKS.

In January, 1893, the town of Petrolea, Ont., made an agreement with the Petrolea Waterworks Company to lay about 40,000 feet of pipe, with 70 hydrants. The water was to be taken from wells in the gravel beds in the townships of Enniskillen or Plympton. In August, 1894, an extension of time was granted to the company, which had then laid only about two miles of piping. In 1895, the company having failed to carry out its agreement, owing to the difficulty in finding a well with a sufficient yield of water, the corporation began operations on its own account by sinking a test well about 4½ miles east of the town, which yielded 70,000 gallons per day, but which was not found to be permanent.

At this point Willis Chipman, C.E., Toronto, was engaged to report on the whole question of water supply. In his first report, August 27th, 1895, four sources of water supply were discussed, of which the River St. Clair and Lake Huron were found to be the best. A second report was presented to the town council by Mr. Chipman, which discussed the Lake Huron scheme. The plan here discussed was adopted by the council, upon the following estimates submitted by the engineer:

| | |
|---|---|
| Pumping station at Lake Huron, including pump house machinery, intake detached residence for engineer .... | $ 15,000 |
| Force main, including right of way and damage..... | 103,000 |
| Distributing system in town, including a sum to purchase the mains already laid by the company..... | 35,000 |
| Standpipe ..... | 8,500 |
| Meters..... | 3,000 |
| Engineering and contingencies..... | 7,000 |
| | $171,500 |

The late Alan Macdougall, C.E., made a report upon the plans prepared by Mr. Chipman, in which he suggested a filter bed in the lake, protected by crib work, and having an area of 7,500 square feet. E. H. Keating, C.E., city engineer of Toronto, was asked to pass upon both schemes. He was in favor of an enlarged conduit pipe and intake, and other alterations which increased the estimate by about $50,000. The town council decided to proceed with the work as planned by Mr. Chipman in his report originally adopted. Work was commenced April 1st, 1896, with Mr. Chipman as engineer in charge.

During April and May the conduit line was located and staked out, the point of intake and site for building selected, and plans and specifications prepared. During this time the right of way for the conduit was secured by the committee. The contract for the whole work except machinery was let to W. Garson & Co., St. Catharines, Ont., for $131,945. The contract for the machinery and boilers was let to the Hughes Steam Pump Co., of Cleveland, Ohio, for $14,289.

The intake pipe is 1,089 feet long from the well to the strainer, and 12 inches in diameter. The depth of water at the outer end is 15 feet, with the lake at 580 feet above the sea level. The intake is so designed that it can at any time be tested for leakage, or flushed out from the pump room. At the outer end is placed a cylindrical crib, or strainer, of ¼ inch boiler plate, 4 feet in diameter and 5 feet high, the upper part being perforated with ½ inch holes, spaced 1½ inches centre to centre. The top of the strainer is about 10 feet below the lake surface. It is protected by ten twelve-inch piles. The intake pipe was completed and lowered to grade in April, 1897. Considerable difficulty had been experienced in laying the intake pipe, as a sand bar 150 feet from the shore refilled the trench, which was dredged for the pipe several times.

The pipe also parted on a couple of occasions. Upon subjecting the pipe to a test pressure of 20 lbs. to the square inch, a leakage of 25 gallons per minute was determined. It was discovered that the strainer had lost its upright position owing to the sandy clay washing out from one side. It was righted by dredging under the other side, and was then connected with the wooden piles, which surround it by a heavy iron chain. It is the opinion of the engineer that the strainer will eventually have to be protected against accident by a stone filled cribwork.

The pump well is circular, with an interior diameter of 14 feet, and a depth of 12 feet below the surface of the lake when it is at 580. The floor level of the engine-room is 6 feet above this lake level, and 11 feet below the ground surface. The material passed through in excavating for the well below the floor level of the engine-room, was entirely a blue clay through which no water whatever percolated from the lake. The walls of the well are of hard brick laid in Portland cement. The top of the intake where it enters the well is at elevation 576, thus giving about four feet of head in the pipe with the present lake level. By an arrangement of pipes and valves in the well, water can be pumped directly through the intake, and water can be turned back through the intake by an 8-inch connecting pipe from the discharge main. The lower four feet of the well cannot be pumped out by the main engines, this space being left for sediment to collect, but it can be pumped out at any time through a flexible iron section pipe by boiler feed pump. The well is entirely outside the building, and is covered.

The pump-house is located on the northeast corner of lot 9, 8th concession of the township of Sarnia. It is a white brick building 30 x 100 feet, divided into engine-

room, boiler-room and coal shed. The smoke stack is of brick, 73 feet high, 8 feet square at the base, with a flue 30 inches square. Near the pump-house a two story brick house for the engineer was built.

From the pump-house to the town limits of Petrolea, the conduit line is of cast iron pipes 12 inches in diameter. The length of the line is 57,943 feet, but the 12-inch main continues 3,705 feet to the water tower, and 4,502 feet to Petrolea street, the whole distance being nearly 12 miles. All the pipes are laid to grade, most of the line having an inclination of one in 1,000 only. On the line are seven gate valves, four automatic air valves, and four blow-off valves.

The pipe was supplied by the Gartshore-Thompson Pipe Foundry Co., Hamilton, except about 15,300 feet, which was supplied by the St. Lawrence Foundry Co., of Toronto. Several weights of pipes were used, the heaviest being at the north end. The conduit line was tested by maintaining the pressure of 200 lbs. to the square inch at the pump-house, for six consecutive hours. Very few leaks were discovered, and only three pipes failed in the preliminary tests made by the contractor. This pressure of 200 lbs. at the pumping station gives 147 lbs. at the height of land, and from 160 to 180 lbs. in the town. This is the longest waterworks conduit in Ontario, working under pressure.

The distribution pipes were laid with four feet six inches of covering, and generally in stiff, blue clay. The valves were manufactured by the Doherty Manufacturing Co., of Sarnia, and the hydrants by the Kerr Engine Co., of Walkerville. The hydrants have five-inch barrels, and are provided with a four-inch steamer nozzle, in addition to the two ordinary hose nozzles. The valve chambers are of hard brick laid in cement with heavy cast-iron manhole covers.

All valves are provided with extension spindles. Gate valves with valve boxes were placed on all the hydrant branches on the 12-inch mains, in order to permit the repairing of these hydrants without closing the valves on the 12-inch main. Two three-inch relief valves were placed on the system at a very low point where the pressure is greatest, also two of the same size under the water tower. These valves are set to relieve the mains when the pressure exceeds 120 lbs. The total length of pipe in conduit and distribution system is nearly 22 miles.

The water tower is of steel, 25 feet in diameter and 85 feet high. It rests upon a foundation of very heavy stone masonry laid in Portland cement mortar. The cylinder is well anchored to the masonry and has an ornamental balcony at the top, reached by a ladder. The tower contains about 257,700 Imperial gallons, or approximately 3,000 gallons per foot in height of the tower; when full it will give a pressure at the fire hydrants varying from 25 lbs. to 50 lbs., the average being about 30 lbs. To give domestic pressure in town, it will be necessary to keep the tower half filled at all times. The water in the lower half will be available for fire supply, but not for domestic purposes. By cutting off the tower, a good fire pressure can be given direct by pumping from the lake.

There are two pumping engines, one a compound "Duplex," and the other a compound "High Duty Fly Wheel." The first was manufactured by the Hughes Steam Pump Co., the second by the London Machine Tool Co., of London, Ontario. The duplex has steam cylinders, 14 inches and 26 inches in diameter, plungers 10 inches diameter, all with 18-inch stroke. The high duty engine has steam cylinders 13 inches and 26 inches diameter, water plungers 6½ inches diameter, with 32-inch stroke. It is speeded to make about 50 revolutions per minute. This engine is a very compact machine, the fly-wheel revolving on a shaft placed near the steam end. Each of these pumps has an easy capacity of 700 Imperial gallons per minute, or one million gallons per twenty-four hours, against a head of 200 lbs. to the square inch. One independent fly-wheel air pump, with feed pump attached, is operated in conjunction with a surface condenser, placed on the discharge main. A duplex feed pump supplies the water to the boilers. This pump can be used to empty the well, to pump into the conduit, or for hose service at the pumping station. Three 3-inch relief valves are placed in the engine room, with ample discharge pipes. Steam is supplied by two return tubular boilers 16 feet long, 62 inches in diameter each, with 68 tubes 3½ inches in diameter. These boilers were made and set by the Stevenson Boiler Works of Petrolea. Although both engines were in running order on January 1st, 1897, the contractors for machinery were not ready to test the pumping engines until February. The first test was made on February 4th and 5th, J. H. Killey, Esq., of Hamilton, representing the pump manufacturers. The fly-wheel pump was run ten consecutive hours under 200 lbs. water pressure, at the rate of 1,000,000 gallons per 24 hours, the coal consumption being 2,300 lbs. The duplex, in 10 hours, under the same pressure, and pumping at the same rate, consumed 4,400 lbs. This test gave a duty considerably below that guaranteed for the fly-wheel pump, but the duplex exceeded the guaranteed duty. On March 18th and 19th a second duty test was made of the fly-wheel engine in the presence of the manufacturers. During ten hours the coal consumed was 2,430 lbs.; ashes removed, 121 lbs.; water pumped, 462,338 imperial gallons; water pressure, 200 lbs.; suction lift, 14 feet; temperature of feed water, 109 F. The duty determined from the above is 98,570,000 foot lbs. per 100 lbs. of coal. The duty of the duplex engine was found to be 55,000,000 foot lbs.

The only defect in the Petrolea water supply system is that the pressure is not sufficient for fire protection. The town has, however, two fire engines, and all hydrants are provided with steamer nozzles. The engineer recommends that when the amount to be pumped daily increases to over 500,000 gallons, a pumping station should be erected near the water-tower, to be provided with two underwriter fire pumps of the same capacity as those at the lake pumping station. In this way water could be pumped out of the tower or the conduit line, and forced into the system under any pressure desired.

The quantity of water available is about 1,000,000 gallons per twenty-four hours. This quantity of water would supply a population of 10,000 people, allowing 100 gallons per day for each person. This is the quantity pumped in London, Brockville and Toronto, but less than that pumped in Sarnia, Port Huron, Windsor, Detroit, Cleveland, Buffalo and other lake cities and towns.

In spite of the recommendations of the engineer, that meters should be placed on all the services, they were only placed upon the services of the large consumers. As the original plans of the system were prepared with the idea of using meters all round, it will probably not be found adequate if the small consumers are allowed to waste the wate. This matter, however, can probably be adjusted when the difficulty arises.

---

The Farmers' Hedge and Wire Fence Company of Ottawa, Limited, has received an Ontario charter. Capital, $25,000. The incorporators are J. Bright, Myrtle, Ont.; J Vipond, Brooklin, Ont.; R. R. Mowbray, Kinsale, Ont.; E. E. Cooper, East Whitby, Ont.; J. D. Howden, Whitby, Ont.

## THE GREAT LAKES AS A SENSITIVE BAROMETER.

BY F. NAPIER DENISON, METEOROLOGICAL SERVICE OF CANADA.

*Concluded from last issue.*

From a careful study of the subject, with the assistance of the foregoing tabulations and records, the following points have been deduced:

(1) That when the lake record is least disturbed, so is the barometric trace.

(2) When the lake undulations become large and rapid, so do the atmospheric waves as recorded upon the barograph.

(3) There is a marked correspondence between the time intervals of these undulations as recorded by both instruments, the larger waves averaging 20 minutes, and the smaller ones 10 minutes.

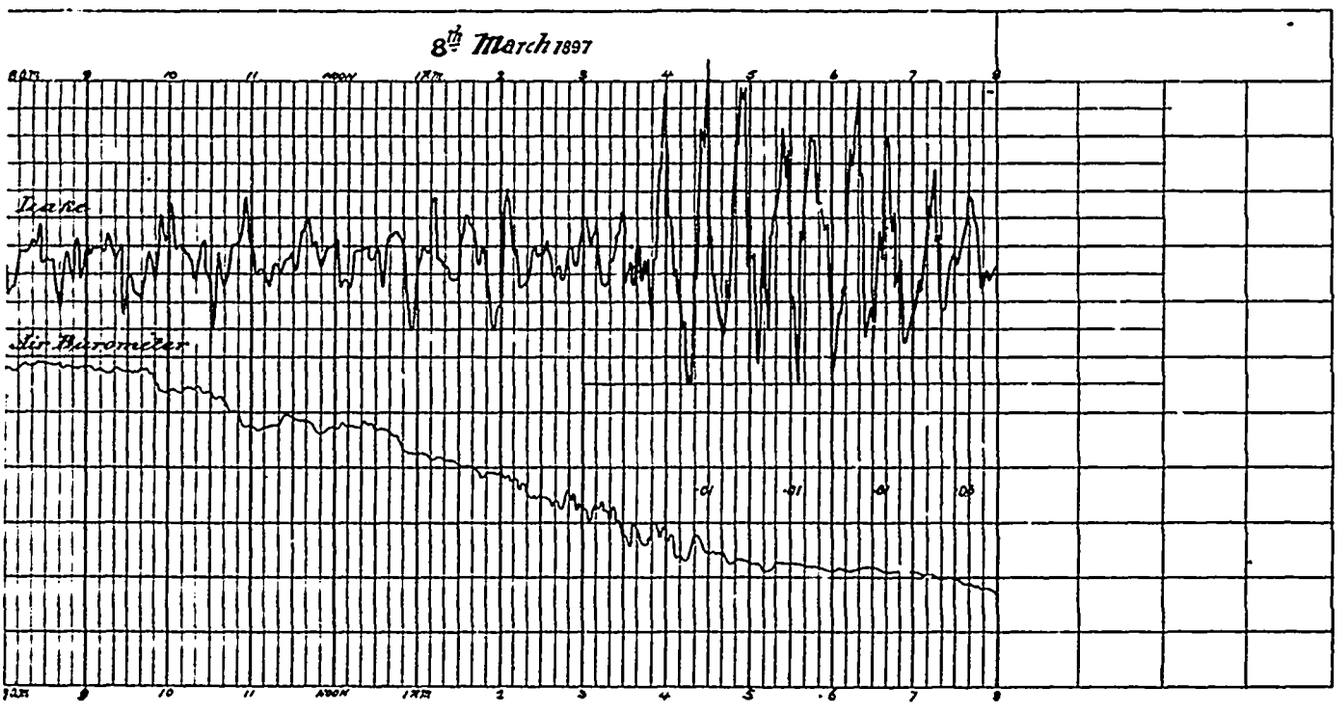
(4) That the lake level is never stationary; the smallest movements recorded for twelve consecutive hours was ½ to 1 inch, when the barograph trace was also very quiet.

(5) That the longitudinal and transverse "seiches" are due to great differences of atmospheric pressure between the extremities of the lake, which are doubtless augmented when the gale strikes the water's surface. These "seiches" consequently appear shortly before, during, and for several days after the passage of some severe storms. The lake trace before us clearly shows this movement, and the following chart the position of the barometric gradient at the time of this record. From a limited number of observations the time interval of these "seiches" appears to be four hours and 49 minutes, and 45 minutes respectively. Should the isobars lie parallel with the length of the lake during the passage of a storm, the "seiche" movements become almost imperceptible. (The quiet traces of both barograph and lake instrument for the 27th February last, bear this out). This may explain why little or no undulations were remarked by Professor Forel, upon the Swiss Lakes, on certain days, although the wind was strong.

(6) The rapid heaping up of the water at one end of the lake, which is also due to great differences of atmospheric pressure between its extremities, in conjunction with the action of the wind, sets up powerful currents at both top and bottom of our lakes, which although of great sanitary benefit, particularly to the fish, cause much inconvenience and often loss of property to the fishermen; for after such disturbances, their nets, if set at right angles to the length of the lake, often drag their anchors some distance, and when brought to the surface are found to be filled with debris from the bottom of the lake. Such rapid changes of water level are invariably followed by the "seiches" or movements of oscillation of the whole lake's surface.

(7) That the smaller undulations are due to the direct action of the atmospheric waves or billows as they move over the surface of the lake, tending to form minute undulations upon the surface, corresponding in length to these billows, and as they move further into the bay, becoming magnified as they reach narrower and shallower portions, until finally they assume the proportions recorded upon the instrument.

(8) That these lake undulations become rapid and of great amplitude during fine weather, and a rising or stationary barometer when an important anti-cyclone is central over the lake region, and a pronounced cyclonic area is developing over the Southern States. This clearly




demonstrates the existence of great atmospheric waves, set up along the boundary surfaces of the upper and lower strata, caused by the upper portion of the lower air stratum, not being retarded by friction from contact with the earth, and of greater specific gravity than that to the south of it, beginning to move towards the region of lighter air, viz., in a southerly direction. The barometric gradient being small, the movement is slow, but in an opposite direction to the upper stratum, which is less dense and rapidly moving polewards.

(9) The falsely termed "tidal waves" encountered upon the lakes, especially upon Lake Erie, are due to large and rapid atmospheric changes, so often noticeable upon the barograph preceding or during thunderstorm conditions. The above is a fair illustration of the smaller "waves" as shown upon the Humber instrument for the 8th of March last. Here you will observe that both barometric and lake traces are decidedly disturbed until 2.45 p.m., when several abnormal undulations appear upon the barograph, followed shortly afterwards by correspondingly large lake undulations, greatest amplitude 11½ inches in 15 minutes. You will also notice the marked 10 minute intervals be-

tween the smaller waves or "notches," as Professor Darwin would call them, upon the larger undulations. During this day thunderstorms were general near Lake Erie, while in the vicinity of Toronto there were only light showers.

(10) The larger lake undulations may account for the existence of the greater waves so frequently encountered by fishermen and sailors at apparently regular intervals. These are often termed "the three sisters" or "sister waves," as they usually appear in threes, the centre one being the largest. The central wave appears to coincide with the crest of such an undulation.

Before concluding permit me briefly to apply this study to the ocean tidal records as a probable means of accounting for what are termed "secondary undulations." From a careful study of certain St. John, N.B., and Halifax, N.S., tidal curves, furnished through the kindness of W. Bell Dawson, director of our tidal service, in conjunction with the synoptic weather charts, similar results to those upon the lakes were obtained.* These secondary undulations become most pronounced during fine anticyclonic weather, preceding by many hours the advent of approaching storms from the south and south-west. On the other hand the traces become quite quiet when the pressure is increasing to the westward of these stations, which is usually a precursor of fine settled weather.

These undulations are not due to "seiches," or movements of oscillation, which can only apply to enclosed bodies of water, but to the direct action of atmospheric waves or billows. These tend to form minute undulations upon the surface of the water at the entrance to bays, etc., which, as previously stated, become greatly magnified at the narrower and shallower ends of these arms of the sea. These secondary undulations exist throughout the world at all tidal stations, situated as stated above. They are graphically shown upon some of the tidal diagrams which form part of Admiral Wharton's report for the Royal Society upon the "Krakatoa Seismic Sea Waves"; also by Major Baird and others. It is interesting to note the marked regular and continuous undulations at Honolulu, which, if more thoroughly studied, may prove to be due to the influence of the North-east trades.

Finally, permit me to draw a few conclusions in connection with what has been brought before you. Modern meteorologists realize the necessity for a better knowledge of the upper atmosphere as a means of improving our present methods of weather forecasting, and have already done much through the use of kites, balloons, and cloud observations. May we not add the study of atmospheric undulations, as shown upon the lake and sensitive barograph records? The two former means are dependent upon certain atmospheric conditions, while the study of the clouds may often be confined to the lowest stratum, and at other times the sky may be quite clear; whereas the latter can be studied continuously, during all types of weather, by stationary instruments at the bottom of this ocean of air. Since these undulations occur upon all waters, would it not be of great scientific and commercial value not only to increase the number of these instruments upon the great lakes, but in place of eliminating these movements when tabulating ocean tidal records, to magnify their amplitude and study them in conjunction with the corresponding synoptic weather charts? Should the theory upon which the foregoing suggestions are based prove correct, such observations would be especially useful along a western seaboard, such as that of Great Britain, or our own British Columbian coast, indicating the existence or approach of ocean storms many hours previous to a fall in barometer at these stations. In conclusion may we not look forward to a day not far distant, when the ordinary mercurial barometer will be superseded by more sensitive self-recording instruments, and when the study of atmospheric waves will have become universal? Then will the forecast official be supplied, not merely with the actual barometer readings now furnished by the telegraph stations throughout his country, but by a special cypher code, with the undulatory condition of the atmosphere at these stations; and with such an increase of data at his disposal, who can fix a limit to the possibilities of weather prediction in the future?

*A probable solution of the secondary undulations found upon Self-recording Tide Gauges. Proceedings of the Canadian Institute, 1897.

*For* THE CANADIAN ENGINEER.

## THE ADVANTAGES OF THE SEPARATE SEWAGE SYSTEM.

BY W. M. WATSON, TORONTO.

The celebrated scientist, Ward, said that when arranging a system of drains and sewers, the rain water should be conveyed to some stream and the sewage to the soil, and there is sound logic in his remarks. It is of more importance to have two sets of drains, one to carry off sewage only, and another set to carry off rain water and the waters collected from springs and clean land, than many persons appear to suppose. Where the two-set method is installed, it will be found to be of incalculable advantage to the preservation of the public health.

If we take Toronto, which uses the combined system of drainage, for an example, we note that considerable claims are very often put in for damages done to property, on account of sewage and sewage deposits being forced back through the sewers into cellars and basements, and the damage claimed on this account is only a small percentage of the real damage done by the sewage being forced back on to private property during rain storms. Then there are thousands of street gullies, with large bags or pockets, which catch and retain the manurial and vegetable deposits washed off the street, which lie motionless, and by so doing set up fermentation and putrefaction, causing foul, unhealthy smells. These also we find to be periodically emptied of the foul matter right under the nose of the pedestrians. The cost of these trapped gullies when installed, and the periodical cleaning, is a large amount, and is almost sufficient to pay the expense of laying down a simple, shallow and inexpensive system of storm and rain water sewers.

There is nothing in connection with sanitary appliances that can do so much injury to the health of the house occupants as the sewage and the sediment being forced back out of the drain into the basement after putrefaction has set in, and I believe many of the poorest people live unhealthy lives and die of disease because of the practice of mixing sewage and storm water in one sewer.

It is a dangerous practice to put in sewers too large for the ordinary flow, because when that is the case, the flow is indolent and sluggish and moves as it pleases, taking a rest occasionally, and allowing the poisonous solids which it contains to be deposited in the bed of the channel, making the conduit into a settling tank, in fact upsetting every arrangement and duty that the sewers were intended to perform. Water is used to clean and to carry or float away filth or dirt, and it is avoiding its duty if it drops or lets go the solids which it is intended to carry away before the stream reaches the final outfall. The solids which are deposited, silt up the drains, reducing the size; they heat, ferment and putrefy, and manufacture

a dangerous and poisonous gas in large quantities, which is discharged through the ventilation-grates, contaminating the atmosphere, and it also presses through the seals of the gully and other traps. If a town's sewers are constructed so as to be capable of handling both sewage and rainstorm water, then they must be 75 per cent. too large for the quantity of straight sewage discharged. The rainstorms will only average about one hour per week, which leaves 167 hours a week for the sewers to act as a chamber for the generating of dangerous gases from putrid matters.

It is impossible to tell what size of drain or conduit will be necessary to cope with the waters discharged by a rainstorm, and if the heaviest rainfalls are provided for by the combined system, large expensive pipes must be laid at a great depth, necessary to collect the domestic sewage and trade refuse as well, while by the separate system large volumes of water which only fall probably six times in a year, could be easily conducted to the proper outfall by surface or shallow inexpensive channels, and by the natural water-courses. On the other hand it is easy to compute the quantity of flow of sewage, for it is very regular and only changes in quantity during the night, Sundays, and holidays; there is seldom more than 15 gallons of domestic sewage discharged per head per day from water closets, baths, wash basins and sinks. The average trade refuse can be secured by reading the water meters, telling the amount of w[illegible]r used by each manufacturer or firm, and an estimate may be taken of the discharge from public baths, stables, or any other unusual sewage a town may have to handle. Thus a reasonably close figure can be got that will answer to give the size of pipes for each district and the main trunk sewer, and the quantity discharged will usually vary so very little that a small margin only in the size allowed to carry the estimated quantity will be necessary to meet contingencies.

Drains laid down the proper size to carry the necessary quantity of flow will always be self-cleaning, if given a very moderate downward grade, and the sewage passed through them will keep continually on the run, from the moment it enters the drain to the time it reaches the final outfall of the sewer; therefore the sewage will be delivered at the outfall just as fresh as when it entered the drain, because it is impossible for moving sewage to ferment, decompose, or putrify, and no dangerous gases will be generated. The public will be protected from inhaling sewer gas by the adoption of the separate drain system if properly and intelligently arranged, independent of the traps and ventilating pipes, which are always introduced into good and efficient plumbing. A drain is greatly to be preferred that is continually getting scoured and cleaned by its own flow, than a sewer that is only scoured when a violent rain storm occurs, or when it is artificially flushed by an expensive and often complicated flushing machinery.

But there is a claim for separate drains over and above the before-mentioned advantages, viz., the disposal and the purification of the sewage before being allowed to enter the rivers or fresh water streams, ponds, lakes, etc. It is about as easy and inexpensive to purify a gallon of straight sewage as it is to clarify and purify a gallon of straight sewage adulterated by 75 per cent. of fresh water, and it is obvious that both the first cost of construction and the annual cost of management of any sewage works working under the separate system of drainage, must be considerably less than where the combined system is adopted. On account of the severity of the Canadian climate in winter, and the great heat in summer, water carriage of excrements will be almost in general use throughout the country, and it is the duty of all engineers to see that their bad effects be reduced to a minimum by confining them into as small a space as can be used for their transmission with quickness and safety to the place appointed for their filtration, purification, or discharge on to the land out of harm's way. About the only serious objection to the separate system of sewers is that the soot, dust and manure from the streets is washed into the storm water drains. Now these substances, if allowed to remain motionless after being soaked by water, will ferment and putrify. Should arrangements be made to bring this material into the sewers, then we must accept also the sand, grit and other heavy substances from the surface of the roads, which soon choke up the gullies and channels. To overcome the difficulty of this objectionable matter passing into the surface or rain water sewers, the storm water might be forced through a large settling tank or reservoir immediately before it discharges into the natural watercourse of sufficient size to allow time for the solids to settle. But even if it is allowed to enter the stream without settling, the fluid will be as pure and free from poison as any of the other water flowing into the river from land and stagnant pools. The whole secret of healthy drainage is to keep the dangerous solids and ingredients contained in sewage moving briskly until they can expel with safety to the public health the dangerous gases they contain, and this can only be done by having a separate drain for the conveyance of sewage and trade refuse.

With regard to the expense, I may say that any experienced and intelligent engineer, with a proper amount of foresight, may install a separate system at about the same price as a combined system. Should the geographical position of any town be such that to introduce two separate systems of drains and sewers will increase the cost considerably, the advantages derived from having the two distinct systems to the preservation of the public health is many times more than the extra cost, and is a good return for the money spent. The dirt from the streets should not be allowed to lie in the pockets of the street gully traps. It is a serious menace to the health of the people. The dirt should pass along with the water and be kept in lively motion until it gets clear away from the people and to a place where the filth can be better handled, or where it will be purged of its dangerous elements. By the double or separate system there would be no need of street gullies with traps; simple grates would answer.

## METAL IMPORTS FROM GREAT BRITAIN.

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

| | Month of Sept., | | Nine months ending Sept., | |
|---|---|---|---|---|
| | 1896. | 1897. | 1896. | 1897. |
| Hardware and cutlery | £6,195 | £7,041 | £48,867 | £50,672 |
| Pig iron | 3,838 | 1,240 | 21,230 | 5,298 |
| Bar, etc. | 1,101 | 977 | 12,626 | 7,572 |
| Railroad | 28,047 | 171 | 158,153 | 38,893 |
| Hoops, sheets, etc. | 4,354 | 13,792 | 35,758 | 55,954 |
| Galvanized sheets | 5,291 | 7,346 | 42,212 | 35,547 |
| Tin plates | 6,401 | 30,073 | 91,909 | 132,849 |
| Cast, wrought, etc., iron | 5,103 | 3,887 | 40,651 | 25,957 |
| Old (for re-manufacture) | 1,058 | 1,937 | 14,862 | 5,191 |
| Steel | 10,519 | 6,258 | 73,060 | 41,061 |
| Lead | 1,015 | 5,170 | 10,486 | 19,062 |
| Tin, unwrought | 419 | 2,403 | 11,716 | 13,814 |

THE Bridgewater Power Co., Bridgewater, N.S., which is putting in an electric plant, has recently purchased from S. Morgan Smith Co., York, Pa., a 30-inch McCormick turbine, mounted on horizontal shaft.

## A NEW OIL FIELD.

An oil well pumping outfit consisting of an "Imperial" gas engine, has been recently installed by the Cooper Machine Company, Limited, Toronto, in the new oil fields near Florence, Ont. This design of engine runs either on natural gas supplied from the well or the gasoline taken direct from the tanks. The illustration shows the entire outfit as arranged with countershafts for connection to the beam of the pump, and the tanks are shown to which the oil is pumped. When first started, the engine ran for some time on the surface flow of natural gas, and as this gave out the gasoline was used instead.

IMPERIAL GAS ENGINE PUMPING OIL WELL, FLORENCE, ONT.

The company is at present making a new design of a pump attachment, in which the slow speed needed for this work is obtained by gearing placed directly on the engine frame, and from which the connection is made without belting. The compactness of this rig recommends itself to interested parties, and the cost of fuel and attention is much less than with steam.

## AN AIR SHIP?

*Editor* CANADIAN ENGINEER.

SIR,—On the evening of September 11th, at about 10 o clock, or perhaps a little later, the attention of myself and several others was directed to a star of unusual appearance by William Graham, Esq., It had two very beautifully colored lights, red and green, which could be noticed fairly well with the naked eye, but much better with the aid of a telescope. It seemed to be several miles away, and was moving towards the north west with considerable speed, at an altitude of about twenty degrees when first seen. We suppo.ed the colored lights were attached to a balloon, but this is mere conjecture. May it not have been a party of moonlight excursionists on a trip to the Klondike?

Yours truly,

WILLIAM J. PHOENIX,
Teacher.

Honora, Manitoulin Islands, Oct. 1st, 1897

## AN AIR SHIP?

*Editor* CANADIAN ENGINEER.

SIR,—In answer to yours of the 22nd Sept, I beg to state when I first detected the light I thought it was the evening star, but it being very large, bright, and more condensed, caused me to observe it carefully, when I noticed it flickering and moving to the north-west I called the attention of the household and neighbors to look at it. I got the glass, so as to draw it nearer for observation, when I detected the three lights, which seemed to blend through one another, as they were in a straight line from me. I did not see the balloon, it being too far away, and the moon was bright. It must have been about half a mile high, and seemed to keep the same elevation, as far as I observed it. In the distance it looked as if a person was carrying a lantern, as the light kept shading It must have been the motion of the balloon which caused it I notice by the clipping you sent me that the balloon was seen at Vancouver on the 13th August, and again on the 16th near Port Arthur, as mentioned in THE CANADIAN ENGINEER for September. Now it appeared here on the 11th September, and again I see by the *World* that it has made its appearance at the north of Russia on the 14th Sept The wind was blowing here from the south-east when I saw the light, which carried it north-west The next day it blew from the south-west, which would send the balloon north-east, and the following day it blew from the north-west, which would send it south-east if the wind was blowing from the same direction all over If it is Andree's balloon, he is, instead of going to the north pole, travelling around the Arctic circle.

Yours truly,

WILLIAM GRAHAM.

We, the undersigned, certify that we saw the light on the 11th September, at about 10 30 o'clock p m, crossing over to the north shore

ALLAN HOUSTON.
WM. F. GRAHAM,
MRS WM. GRAHAM,
MISS ELLA GRAHAM.

Honora, Manitoulin Islands, Oct. 1st, 1897.

## SEWAGE DISPOSAL.

*Editor* CANADIAN ENGINEER:

SIR,—I have read with consi'erable interest Mr. Watson's paper on "Sewage Disposal" in the current number of your excellent journal, but I think Mr Watson is under some misapprehension as to the action of my filter. The filtrate is never water-logged or immersed in water, as he appears to imagine, as the outlet is always open to the atmosphere, and the sewage to be filtered is held back by the finer surface layer, and passes from it in thin films over the coarser grains of the filtering material below, the interstices of which are kept continually filled with fresh air by means of the blower, which is driven either by power got from the sewage itself, or from the engine pumping the sewage, or mixing chemicals, where such is necessary, or by any other outside power; the power required being extremely small, about 1½ horse-power per million gallons filtered being sufficient.

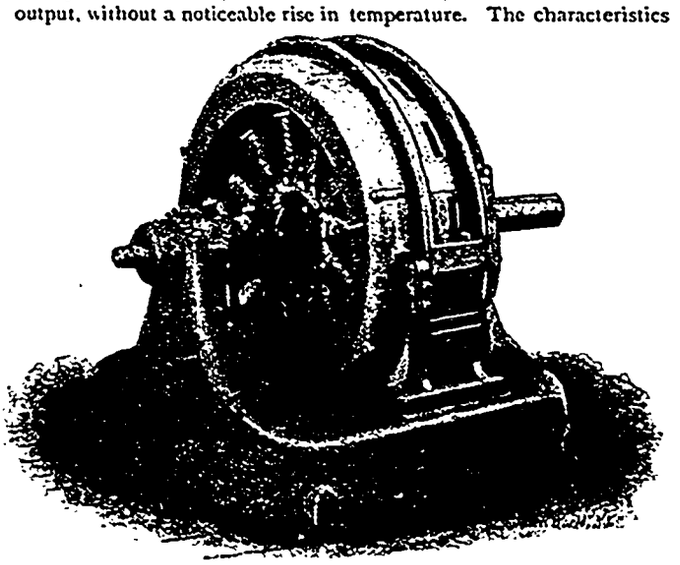
Yours faithfully,

SIDNEY R. LOWCOCK,
A M. Inst. C.E., F.R. Met. Soc., etc,

35 Waterloo St., Birmingham, Eng.

## ELECTRICAL MACHINERY AT THE MERRITTON CARBIDE WORKS.

The Willson Carbide Works Company at Merritton, Ont., is probably the only enterprise engaged in the manufacture of carbide of calcium, which is turning out that much discussed product, daily, up to its full capacity, and at a profit. The electrical apparatus used in this plant is of the most interesting character, having been specially designed by the General Electric Company to suit the peculiar conditions under which the manufacture of carbide can be successfully carried on The company has at present in operation four machines of 150 kilowatts capacity each, and has recently placed an order for two more of the same size, which will be in operation in the course of a couple of months. These generators are of the revolving field type, with stationary armatures, and are designed to run continuously twenty-four hours a day, at a load considerably in excess of the rated output, without a noticeable rise in temperature. The characteristics



REVOLVING FIELD TYPE GENERATOR.

of these machines are such as to enable them to supply a proper amount of current for a furnace at the proper voltage, no matter what the resistance conditions of the arc may be, and they may be short-circuited repeatedly, or even run on a short circuit without injury. The location of two of the power houses renders necessary a transmission at 1,000 volts, and in this case step-down transformers of the Niagara

type are used to reduce the current to the proper voltage for supplying the furnaces. Altogether, the detail and operation of this plant is most interesting, and its success in turning out carbide of calcium on a commercial basis is in marked contrast to the operation of several plants, on a much more ambitious scale, which have been established in the United States.

## AMERICAN STREET RAILWAY ASSOCIATION.

The 16th annual convention of the American Street Railway Association opened at Niagara Falls, N.Y., on the 19th ult. The attendance was very large, and the exhibits more numerous than at any previous convention. Among the Canadian members and visitors present were the following: Frederic Nicholls, president Brantford Street Railway, and general manager of the Canadian General Electric Co.; C. F. Armstrong, E. D. McCormick, and Geo. Watts, all of the Can. Gen. Electric Co.; Frank Badger, Montmorency Electric Co.; J. E. Brown, superintendent, and Mr. Bradley, foreman, Hull Electric Railway; W. A. Johnson, of the W. A. Johnson Electric Co., Toronto; Messrs. Griffiths, Wagner, and Fearman, of the Hamilton Electric Ry.; T. Watson, secretary, and C. K. Green, superintendent of the Hamilton Radial Electric Railway Co.; Wilfrid Phillips, manager Niagara Falls Park and River Ry.; Charles James, Storey Motor Co., Hamilton; A. J. Nelles, and Charles Myles, of the Hamilton, Grimsby and Beamsville Electric Ry.; H. Nicholl, of Kingston Electric Ry.; C. E. A. Carr, manager London Electric Ry., and others.

The president, Robt. McCulloch, announced that eleven street railways had sought membership just previous to the meeting. In his opening address the president spoke of the increasing use of Niagara's great power for electrical purposes, among them being important railway extensions. He praised the work of the Street Railway Accountants' Association, which had been formed in connection with the association.

The first paper was by P. F. Sullivan, manager of the Lowell and Suburban Railway Co., Lowell, Mass., on "Municipal Ownership of Street Railways." He compared the American system of private company ownership with foreign and American municipal systems, and gave the opinions of prominent men. These opinions went to show that the weakness of municipal ownership was the great corruption that existed in city and town councils. American street railways also had a much greater mileage than European city systems, and the latter also made smaller profits.

In the discussion on this paper, Mr. Bean read a newspaper report stating that the recent convention of Mayors held at Columbus, O., endorsed municipal ownership. He stated that in some States the authorities could take over a road by paying for it, in other States they could not possess it till the franchise expired. In Michigan they had the power to parallel a road and so destroy it.

G. W. Knox, engineer of the Chicago City Ry. Co., read a paper on "Some of the difficulties in the construction and operation of Electric Street Railways." He thought many a road now in the hands of a receiver could be made to pay a dividend, if unnecessary extravagances were cut off. The first thing was to select a staff of operators who were interested in their work, from the head foreman down to the man who swept out the waiting-room. Engines and electrical machinery have reached such a state of efficiency that there is not so much chance of economizing there, but there is great room for saving in the purchase of supplies and the outlay for repairs. The unwary railway man has a great amount of experimental claptrap machinery inflicted on him which is apt to cost him dearly. The competition among makers of electrical machinery has led to the adoption of piece-work in its production, so that it has become cheap, but inefficient. In buying machinery, therefore, detailed specifications should be made out for every piece of apparatus, but to do this requires knowledge and discretion. The stock of supplies should be kept low, so as to avoid loss when new developments require a change of designs. An intelligent staff of motor-men is most important, and a commendable practice is to call the heads of departments together regularly for consultation.

In the afternoon a large number of delegates visited the big power-house, the Carborundum Co.'s works, and the extensive works of the Niagara Falls Power and Manufacturing Co., at which place the chief engineer, W. C. Johnson, gave an instructive account of the power development already accomplished and still to be carried out.

Charles Hewett, electrician of the Union Traction Co., of Philadelphia, read a paper on the "Application of the Storage Battery to Electric Traction." The application of the battery system direct to car or locomotive is more costly, and the expense of operating is greater than the trolley system. It is also less reliable, and is objectionable, owing to the gas given off. Although manufacturers have been working since 1880, they have not surmounted the difficulties caused by the great weight of the storage battery and its rapid deterioration. He was confident that the battery requires more power than a trolley car of same size and under same conditions, and requires a larger investment in machinery. Every battery has what may be termed a critical rate of discharge. From zero up to the critical rate the working E.M.F. remains practically constant, but for any particular battery there remains a rate of discharge which cannot be exceeded without useless waste of energy. As Sir David Salomon observes, "it takes power to get current through the battery, and it takes power to get the current out." These critical rates of charge and discharge appear partly due to the time required for the chemical reactions in the battery to take place. For an electric car the battery needs to have a large output for its weight and bulk. To get this it is necessary to increase the surface of active material and decrease the inactive supporting grid; consequently the apparatus becomes mechanically weak. The difficulty is to get the plates large enough to prevent exceeding the critical discharge rate, and at the same time light enough and small enough to be carried on a car. For the same reasons it is doubtful if the lead battery will ever be successful on a car. Great results are expected from experiments now being made in Chicago, but great results have been expected before, and he did not look for any essential improvement from these experiments. In some cities in Europe there is a proscribed area within which overhead lines are not allowed. To overcome this, the cars are provided with batteries large enough to propel them at a low speed for three or four miles to the point where the overhead line may be used. While the cars are completing the trip the batteries are charged from the overhead wire. This arrangement is only a make-shift, and the fact that the battery is only used on the section where it is compulsory, is of itself a proof that it is not the best. It is also significant that the commission appointed by the larger roads in England and Scotland to investigate the various methods of traction in vogue throughout Europe and America, have vetoed any form of battery car. A third phase of the battery-car system is the battery locomotive. Aside from special forms, such as the Heilman locomotive, the one most worthy of mention is the experiment on the New York Elevated Railway, in which the battery is connected in multiple with the line, and charges or discharges according to the demands of the train. When the demand of the motors is sufficient to lower the pressure on the line to or below that of the battery, the battery will then discharge into the motors, thus relieving the feeders. When current is shut off from the motors, the battery will charge. No results of this experiment have been made public yet, but it is difficult to see how much is to be expected. It has the advantage of maintaining a fairly constant pressure at the motors, but this can be accomplished better in other ways. It subjects the battery to usage which history has proved to be disastrous to its life and efficiency. In this method the extra weight of the battery has the certain advantage of giving additional adhesion to the rails. While not wishing to seem pessimistic, he did not think the outlook for the battery-car was bright, unless some combination of elements be discovered whose characteristics are entirely different from the lead battery. The application of the storage battery to the ends of long lines, was, however, a different matter. The battery in this case acts essentially as a pressure regulator. The conditions do not restrict the size of the plates, so that the plates can admit of such a size that the current density on discharge can be kept well within the limits of normal discharge; and in consequence of this the battery is not subject to the great loss due to the fall of E.M.F. on discharge. Only a few such installations have been made, two of which are on the Isle of Man; one has been installed by the Anaconda Mining Co., at Butte, Mont.; there is also a small plant at Merrill, Wis. The first installation, however, that has been made from any large city road for its suburban service, is the one installed by the Union Traction Company, of Philadelphia, Pa. The increase in the travel necessitated a large increase in the car service and length of line, which was extended to a point 11.2 miles from the power-house. The

drop in pressure over this long line made it impossible to run the requisite number of cars, as the speed of a trolley car is approximately in the direct ratio to the applied E.M.F. The investment in feeders for this line had reached a point considerably above $100,000, not including the conduits. To have increased the cable system so as to have supplied this section properly would have required about 336,000 feet of 1,000,000 circular mils. cable, at a net cost for cables, without conduit, of $273,800, which would have been prohibitory. A station of 750-kw. capacity would have cost about $85 per horse power, or a total of $85,000. A battery station, on the other hand, required but little real estate, and would be inexpensive to operate, and its cost would be considerably less than a power station. In the Chestnut Hill plant the entire cost of real estate, battery, and building, was approximately $25,000; to which must be added the cost of a booster in the main power-house. In this installation, however, they simply adapted a 300-kw. generator to this service, so that they were put to but little extra expense in the power-house for adapting it to booster purposes. If we however, deduct $33,000, the cost of the battery and booster, from $85,000, the cost of a station, the difference in the first cost is $52,000 in favor of the battery. In addition to this, they were put to an expense of a little over $13,000 for changes in the cable. As to cost of operation: During May, 1897, the battery-house delivered to the line 103,053 kw. hours. Estimating the cost of local generation of this power at 1½ cents per kw. hour, and adding interest, depreciation, etc., the cost by local generation method for one month is $2,454. The actual cost by the battery method, including depreciation etc., and central station power at 0.6 cent. per kw. hour was $1,100, showing a saving of $1,300 per month by the use of the battery.

The application of the battery to the power-house has not become very generally appreciated, and but few installations have been made. As its advantages become better known, the practice will become more general. The wide fluctuations in load in railway power-houses are now well known. The average daily load varies from 50 per cent. of the maximum in small stations to 70 per cent. of the maximum in the largest stations. From a very large number of observations in all parts of the country he finds that in the majority of stations the average load is very close to two-thirds of the maximum load. Now, the maximum economy of the steam engine exists for a very small range of load, and on each side of the point of maximum economy the efficiency falls off; rapidly on the overload, somewhat less rapidly on the underload. The result is apparent. In most stations the engines, at the best, have an average load of only two-thirds their most efficient load, and as a consequence consume over 45 pounds of coal per kw. hour. With badly regulated engines, and especially with water-power plants, the changes in load are accompanied by variations in speed, and consequently in voltage. These troubles may be entirely corrected by installing a battery. The battery in this case becomes distinctly a load regulator. In potential regulation a comparatively small battery is necessary, since by changing the potential of booster from time to time during the day the charge and discharge can be kept very low. In the case described, a battery rated at 120 amperes has successfully regulated a total output of 1,400 amperes. For load regulation, however, the battery should have a capacity equal to one-third the maximum output of the station. The average load of the station may then be made the maximum load of the engines, the battery taking care of the fluctuations. As in the previous case, there are no physical limitations to be placed on the size of the plates to be used, and the charge and discharge may be kept well within the normal rate. Under such conditions the efficiency of the battery is high—85 to 90 per cent.—and the deterioration very low. In most cases no additional labor will be required. The writer was of opinion that all small stations could be operated better by batteries.

The next paper was by Maurice Hooper, electrician of the Lynn and Boston Railway, of Lynn, Mass., on "The Use of Multiphase Current Transmission for Ordinary Street Railways," which we hope to refer to later on.

Geo. H. Davis, superintendent of the Canal and Clariborne Railway Co., of New Orleans, read a paper on the "Discipline of Employees," in which he held that both good and bad service should be noticed, the former by a complimentary letter, and at times when traffic is very heavy, the employees should receive a share of the increased earnings. Before any man is discharged he should be given a chance to defend himself. A fixed plan of promotions should be adopted.

A committee was appointed with instructions to draw up next year a code of rules for motormen.

Col. Heft, of the New York, New Haven & Hartford railroad, gave an account of their experiences with the third-rail principle construction. The third-rail system had cost them about $3,000 per mile, or about half the cost of overhead construction.

W. J. Heild read a paper on "The Best Method of Settling Claims for Accidents." A sensible man should be at the head of this department, and injured parties should be examined by the company's surgeon, and offers of assistance made. It was very unwise to antagonize anyone who might bring in a claim for damages. Upon settlement a release in full should be taken before witnesses.

A. E. Lang, of Toledo, O., was elected president; W. Caryl Ely, of Niagara Falls, vice-president; and T. C. Penington, Chicago, secretary-treasurer. Boston was chosen as the next place of meeting.

The Canadian Niagara Falls Park and River Railway, the Great Gorge Route and Frontier Railroad, and the Buffalo Railway Co. gave the delegates the freedom of their roads, which was much appreciated.

## KNAPP'S ROLLER BOAT.

Last month the roller boat, designed by F. A. Knapp, and referred to in previous numbers, was towed out into Toronto Bay, and the engines started. The internal platform on which the engines were fixed swayed slightly at first, but was steady when the boat got into motion. Mr. Knapp claimed that the boat made six miles per hour, but a gentleman who accompanied the craft in a skiff measured the speed, and found it to be three miles per hour. There was not a breath of air moving, so that the experiment cannot be said to demonstrate anything as to the seaworthiness of such a boat. After the first trial the flanges, or paddles, were extended, and a second trial—also in a dead calm—resulted in slightly better speed. Mr. Knapp has yet to convince practical seamen and marine engineers how he will obtain power to run against a gale, how he will settle the question of anchoring in rough weather, and enter and leave a port, and how he will stow and discharge his cargo. He has shown that in a calm his boat will roll; he has yet to show that it will navigate.

## THE ELECTRICAL TREATMENT OF IRON ORES.*

The extraction of iron ore magnetically, where the conditions were at all favorable, has been a process long known in the mechanical arts, and not a little of the early study and advance in magnetism was due to the desire to perfect apparatus which should so simplify and cheapen the production that even the leanest deposits of magnetic ore could be worked profitably. Patents dealing with the subject run back through many years, and the litigation of magnetic ore separation has been a long one. Perhaps the most interesting chapter of history in this field, for the public in general, is that due to Thomas A. Edison, who may be said to have turned his energies seriously toward the subject as soon as he had satisfied himself that the foundations were firmly laid for the new art of incandescent lighting. No one thing at any time ever fully occupies the ceaseless activities of that great inventor, but it may be questioned whether during the last five years any other problems have equalled in interest to him those connected with magnetic separation. Hitherto no details of consequence have been given out, but he and his associates have been spending money freely to acquire the workable ore deposits, then to treat them on a large scale of technical and commercial success, and lastly, to market the various products that result from the treatment. The appearance of the present article marks, therefore, the reaching by Mr. Edison of a stage at which he sees the goal of his hopes well in view and touch; and while the data and illustrations we are here permitted to give cannot be taken as final for one whose motto is forever, "Improve," they must be broadly characterized as of a most interesting character, and as revealing the furthest attainment of human effort in the direction of cheapening iron. It should be noted incidentally that in regard to some points, Mr.

*Reprinted from the *Electrical Engineer*, New York, Oct. 28th, 1897.

Edison prefers for the present not to give out all the information desired.

In the mountains of middle Jersey Mr. Edison is now doing his chief work in magnetic separation, but other plants are projected. The veins near the works at the place now called Edison, not far from Lake Hopatcong, are known by careful tests to contain over 200,000,000 tons of iron rock, suitable for crushing. The rock is magnetite in a feldspar gangue, containing about 25 per cent. of oxide of iron, and it can be crushed with ease. The enterprise under prevailing conditions is rendered possible largely by its location, other sources of Bessemer ore being so remote—Lake Superior, 1,200 miles; Cuba, 1,600; Spain, 3,800, or Africa, 4,300. The investment between the Lake Superior mines and the furnaces in the Pittsburg district, consisting of railroads, double sets of ore docks, steamships, etc., as compared with the investment between the mines at Edison and the Eastern furnaces, is as 2.2 to 1.

Returning to the enterprise itself, we may state that the principal buildings are the power-house, crushing plant, stock-house No. 1, refining plant, stock-house No. 2, sand-house, machine shop, and store-room, mixer plant, briquette plant, furnace plant, and stock-house No. 3. Besides these there are 36 smaller buildings, including offices, blacksmith's and carpenter's shops, oil and residence buildings. The power plant includes 7 engines, of 1,800 h.p.; one compound triple expansion engine is that which ran a portion of the machinery department at the French Exposition at Paris in 1889. In the electrical equipment are 10 dynamos and 2 motors. Lighting current is generated for 40 arcs and 700 incandescents, over two and one-half miles of circuit. In the new dynamo room that Mr. Edison has taken much pleasure in laying out, is a cement switchboard, with iron frame, made on the spot, in a few days, for a few dollars. It is not so unornamental as it sounds, by any means.

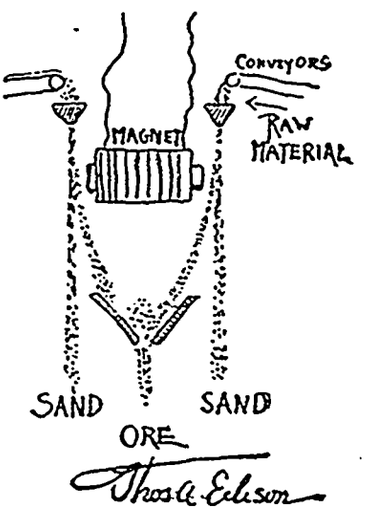
Around the property are some three miles of narrow gauge railroad track, with three locomotives, the trackage varying in length and distribution with the amount of working being done on the different veins. From first to last there is an amazing absence of human labor. All told, including night shifts and day, there are about 250 men around the place. But for the fact that from the moment when the vein is stripped, to the instant when the Edison ore briquette drops on to the outgoing car, no single hand is laid on the material under treatment, there would be two or three able-bodied regiments of laborers of all styles busily engaged on the property. At the outer extremities of these railroad tracks, work two huge excavators, one weighing 60 tons, the other 92, a third one being about to start up. Either of these will bite up four or five tons of rock every minute from the vein, and keep on doing it all through the day. Dynamite is used to get the strata in an amiable and yielding mood, but Mr. Edison considers it infinitely cheaper to do the real smashing up at the breakers, so that the rock is brought away in literal boulders. As each train of double-skip cars is freighted, it is hauled off to the crushing plant, where two 7-ton electric cranes, sturdy and effective, and one of them with earmarks of home production, lift it up and drop it into the jaws of the giant crushers, the skips being then lowered back to the trucks for the next trip. Four thousand tons of crude ore a day is fair working.

The big rolls, studded with knobs, that are a combination of claw and fist, weigh some 130 tons, of which 70 tons is in the moving parts. They are driven by a friction belt, so lightly adjusted that in starting up from a state of rest, a touch with a lever is needed for the initial impetus, when the belt and friction bring them up to full speed, with a circumferential velocity of a mile per minute. As the rock disappears between them they slow down, and the friction belt again speeds them up for the next load. The faces of the rolls are 16 inches apart, so that a 15-inch lump could go through, but nothing larger than that retains its identity.

The ore then goes to a pair of intermediate rolls, which are directly under the first, and of the same type, driven in the same way, [illegible] at a higher peripheral speed. These rolls are about 7½ inches apart. The ore passes to elevator No. 1 and is delivered to the top of the building. It then goes through three pairs of rolls 36 inches in diameter, and is reduced to particles of one-half inches, proceeding en route through a dryer which gets rid of all the ice, or snow, or moisture, and is then taken by conveyer and elevator to stock-house No. 1. The rolls are fitted with a most ingenious device, which effectively eliminates the possibility of breakage, and there is no piece of crushing machinery, pair of gears, pulley, or other moving mechanism in the entire plant, from one end to the other, that is not in some part of it connected up by "breaking pins." These in their respective sizes will just carry the work at full load. If anything goes wrong in the way of strains, or if nuts, bolts, or any foreign substances get into the machine, the pins break, and no damage is done to the machinery itself. The idea is really a clever adaptation of the safety fuse principle. The pins are sized down to one-thousandth of an inch. To the employment of this simple device is owing the fact that in all the experimental work that has been done in preparation, as well as in the actual running of the plant, the total breakage has amounted to only a few hundred dollars.

After having been delivered to the stock-house the material is taken continuously, or later, by a conveyor with iron buckets, which runs at a slow speed and has a large capacity, and is delivered at the refining plant, directly over the "three-high" rolls for further reduction. When Mr. Edison first started the work he began experimenting with ordinary Cornish crushing rolls. After making several hundred experiments as to speeds, pressures, and feeds of various numbers of tons per hour, he determined the fact that the friction of the machine was about 82 per cent. of the power applied, leaving only 18 per cent. for the actual work of crushing. He then set to work to improve the ordinary rolls, with the result of evolving "three high" rolls, which have more than reversed the former conditions, the friction of these machines being about 16 per cent., leaving 84 per cent. of the power applied to do the work. In the old type of Cornish roll it was found that the friction was largely due to a moving shaft running against a fixed bearing under great pressures; in the new machines it is so arranged that the bearing moves at the same rate of speed as the shaft, permitting great pressures with a minimum friction. The moving bearings are made up of wire ropes.

The ore is next carried to the 14-mesh screens, the portion too large to pass being returned for recrushing, while the remainder goes on to the first set of magnets. The magnetic building is 95 feet high, 28 feet wide, and 140 feet long, and will handle 300 tons of crushed rock per hour. The magnets have about one mile of face, and the ore is caused to fall in such wise and at such a rate before them, but not touching them, that the iron is deflected, while the gangue or tailing goes right straight down. The magnets are of special form,




6 feet long and 12 inches wide, in banks of 3 high, their power increasing from the top one to the lowest. At the start the weakest magnet at the top frees the purest particles, and the second takes care of others; but the third catches those to which rock adheres, and will extract particles of which only one-eighth is iron. This batch of material goes back for another crushing, so that everything is subjected to an equality of refinement. We are now in sight of the real "concentrates," which are conveyed to the dryer No. 2 for drying again, and are then delivered to the 50-mesh screens. Whatever is fine enough goes through to the 8-inch magnets, and the remainder goes back for re-crushing. Below the 8-inch magnets the dust is blown out of the particles mechanically, and they go to the 4-inch magnets for final cleansing and separation. Current at determined voltage and amperage is delivered to the magnets from special dynamos through a special regulating and indicating switchboard. Obviously at each step the percentage

of feld-spar, phosphorus, etc., is less and less until in the final concentrates the percentage of oxide is from 91 to 93 per cent. As was intimated at the outset, the tailings will be 75 per cent. of the rock taken from the veins or ore, so that every four tons of crude, raw, low-grade ore will have yielded, roughly, one ton of high-grade concentrate, and three tons of sand, the latter having also its value in various ways, to be referred to later. The sand is transported to the rear of the works, and there stored in a miniature mountain, from which it can be easily loaded into cars and carried away. The concentrate in its fine, powdery state, is delivered into the stock-house No. 2, holding 5,000 tons, or stock-house No. 3, which has a capacity of 30,000 tons. The object of these numerous stock-houses is to allow any part of the works to go on for some time, despite interruption at other points; and thus, so to speak, the "load line" of output can be kept level.

From the stock-houses the concentrates are delivered to another building and into the mixers, long, cylindrical machines equipped with paddles, called "spreaders" and "smoothers." To the mixers a binding material of special nature is fed at one end, and after being churned up, the new coherent, pasty ore is taken by conveyors to the briquetting machines in the same building. At these machines it is compressed into briquettes weighing a little over one pound, 1¼ inches thick by 3 inches in diameter. There are now 30 of these machines in use. In the briquetting machine the ore receives pressures running up to thousands of pounds on the whole diameter. The briquettes are then dropped by the machine on to conveyer bands, which transport them to the furnaces in which they are dried. They remain in the furnace about one hour, and are subjected, as they travel very slowly, to a temperature of not less than 600 deg. F. They are then carried away by the conveyer and loaded into the cars waiting on the railroad outside. The economy of labor is still so elaborated that it requires but one man to load the briquettes, distribute them in the cars, and put the cars in position, the whole thing being done by machinery actuated by the pressure of two levers. The operator can load five cars without having to change his position.

The earlier briquettes worried Mr. Edison by the amount of moisture they absorbed. Then the concentrates did not work nicely in the furnaces, but inclined to blow out, owing to the high pressure of blast, and in other ways they interfered with the regular working of the furnaces. The difficulties to overcome were serious. Very little binding material was an essential. The first cost of such material must be very low. The briquettes must be prevented from absorbing moisture, but at the same time must be left porous to the gases in the blast furnace. Finally, the briquette must be hard at ordinary temperatures, so that it could be shipped like coal, and it must not disintegrate immediately under the fierce heat in the blast furnace. To accomplish all the above, Mr. Edison tried thousands of experiments before he found the correct binding material. The briquette now made will absorb 26 per cent. of its own volume of alcohol, but repels water absolutely.

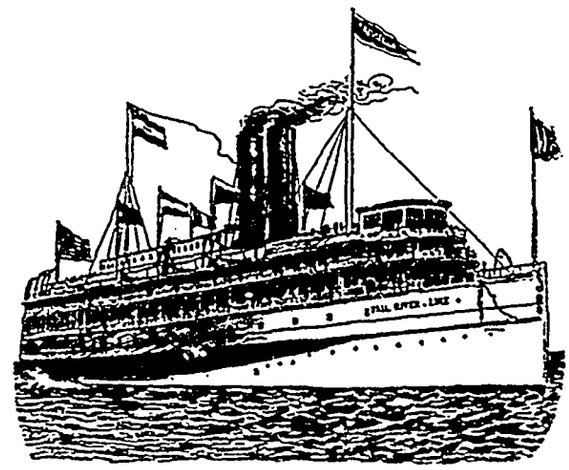
As to results in the furnace it has been found that by the use of the briquettes the output per ton of pig iron per day can be increased from 35 to 50 per cent. over the ordinary mixtures of ores now being used, with a lesser consumption of limestone and fuel. Besides, as already pointed out, this ore has but 100 miles to travel to its destination, and seems not unlikely to assume vast importance in helping to maintain the prosperity of the iron-producing districts of the East, to say nothing of its effect on the export of iron, now beginning to assume such large proportions.

Many features of ingenious time-saving, labor-saving, material-saving about the works could be dwelt on, for Mr. Edison, while optimistic and enthusiastic, is always keen after the shaving of each mill from the cost. Of new contrivances to get around difficulties there are a great number, some relating to the dust, for it is evident that in such ore-milling works the particles fly about thickly. The dust was for a long time a nuisance in the bearings of the elevators and conveyors, but at last Mr. Edison came to the conclusion that as it could not be got rid of he would turn the bane into an antidote. He now has a form of oil feed and bearing in which, after the oil is fed, the bearing is dusted over so as to prevent the oil running away. Dust from the surrounding air soon cakes on additionally, but as soon as the film grows too thick and heavy it is automatically flicked off, when the oil feeds again. The dust skin or shell reforms, and the same cycle is repeated indefinitely. The bearings are thoroughly protected, and once a month is often enough for refilling the oil cups.

The manufactured sand is sharp and crystalline, and, of course, remarkably even as to quality, besides being free from deleterious salts, etc. Natural sand, moreover, is rounded. The Edison sand has special qualities, and is a valuable element is the best cement or mortar. It is just the thing for the sand-box of the trolley car or the locomotive, not absorbing moisture. It is already in demand for various industrial purposes, and being a by-product in enormous quantities, its price is very low.

## THE RICHELIEU AND ONTARIO NAVIGATION COMPANY

The Richelieu and Ontario Navigation Co. is in possession of one of the most attractive tourist routes in the world, and in order to bring large numbers of travellers to its boats it has been decided to equip the fleet with steamers which will compare favorably with any fresh-water vessels afloat. The type of construction chosen is that of the famous Fall River steamers, which are known where tourists meet together as models of all that passenger boats should be. The "Priscilla," of the Fall River fleet, is shown in the accompanying illustration, as giving a very fair idea of what the two new boats to be built by the Bertram Engine Works Co., Limited, Toronto, will be like. The dimensions are: Length over all, 277 feet; depth, 14 feet. The structural hull work is of open hearth steel. Each steamer will contain 140 state-rooms, and in addition, a large sleeping cabin below deck aft, where the dining-room generally is placed on earlier steamboat designs. The



full passenger sleeping accommodation on board is 428, the number of passengers allowed by law being over 1,500. A feature of the design is the placing of the dining saloon on the upper deck, forward, giving light, air, and an opportunity even at meals, for an unobstructed view of points of interest along the route. The tables are arranged for seating at one time 112. The chief engineer of the Bertram Engine Works Co., Arendt Angstrom, who has been with them for the last five years, is well able to build the steamers. He is a native of Stockholm, Sweden, and a graduate of the French Government College for Naval Construction. Before coming to Toronto he was for a number of years chief engineer of the Cleveland Ship-Building Company, and previous to that time was consulting engineer with the Fall River line.

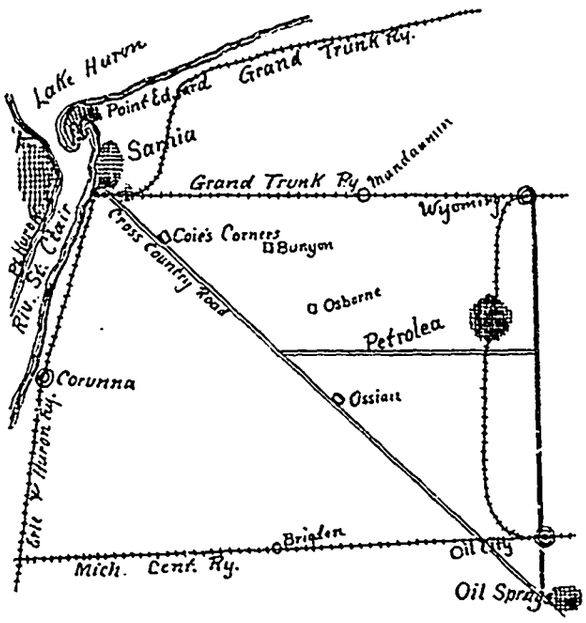
## ANSWERS TO CORRESPONDENTS.

J.M., Ashcroft, B.C.—To become a marine engineer on the Canadian lakes it is necessary first to obtain a fourth-class engineer's certificate. The following qualifications are necessary for a fourth-class certificate: The applicant shall (a) be over twenty-one years of age; (b) he shall have served an apprenticeship of not less than thirty-six months in a steam engine shop, and been employed on the making and repairing of steam engines, or if he has not served such apprenticeship, he shall have been employed for not less than thirty-six months as a journeyman mechanic in some workshop, on the making and repairing of steam engines; or (c) he shall have served at least thirty-six months in an engine-room of a steamboat, as engineer on the watch; or (d) he shall have served not less than thirty-six months as oiler on the watch in the engine-room of a steamer of not less than thirty normal horse power; or (e)

he shall have served not less than forty-eight months as fireman on the watch in the firehold of a steamboat of not less than thirty nominal horse power; (f) And in any of the above-mentioned cases of service, twelve (12) months' service in a boiler shop on the making and repairing of steam boilers, may be accepted in lieu of twelve months of the service named. (g) Service in the dual capacity of engineer and fireman, or oiler and fireman, will only be accepted as fireman service for fourth, and not for any other class of engineer. (h) He shall be able to read and write a legible hand. (i) He shall understand the construction and operation of the feed-water pump, water gauges and safety valves; he shall know when a boiler is foaming, and how to stop the foaming, and also the dangers resulting from neglect to keep the boiler clean, and the usual methods of cleaning it.

## PROPOSED SARNIA—PETROLEA RAILWAY.

A proposal has been made to build an electric railway from Sarnia to Petrolea, a distance of 16 miles, the scheme contemplating extensions to Point Edward at the Sarnia end, and to Oil Springs and Oil City at the Petrolea end, with an ultimate projection into the township of Dawn, which is a very rich agricultural area now being opened up for settlement, but without railway communication of any kind at present. Sarnia now has a horse-car system, operated by a local company, called the Sarnia Street Railway Company, and this company's charter, granted in 1874, gives the company authority to extend the road to adjoining municipalities within the County of Lambton, and the right of way would thus be provided for. According




to the census of 1891, Sarnia had a population of 6,692; Point Edward, which is a lake suburb, almost immediately adjoining, had 1,881; Petrolea, 4,357; Oil Springs, 1,138; and the county itself, which is a very rich agricultural district, a population of 47,715. The wages paid out each day in the oil industry of Petrolea averages $1,800 to $2,000, and those of Oil Springs about $700 a day. In summer the excursion traffic from Petrolea and the other inland towns to the breezy shore of Lake Huron would be very considerable, while the local traffic in freight and produce to Petrolea and Sarnia from the intervening rural districts would be constant and profitable. There are about 6,000 oil wells in Petrolea, and about 2,000 in Oil Springs, and the traffic due directly to the oil industry is large, and still extending. In Sarnia the new oil refinery of the Bushnell Oil Co.—one of the most complete and modern in the world—is now in operation, adding an important permanent industry to the town, while natural gas is likely soon to be a product of the vicinity. Sarnia and its suburb of Point Edward form an attractive summer resort. A wide, clean beach, affording a fine view of the immense traffic that streams up and down the St. Clair River to and from Lake Huron, together with pure water and pure air, render the scene delightful to an excursionist, while recreation is already provided near at hand in a handsome park and pavilion, a race course and bicycle track. In short, the conditions seem already complete and the time ripe for a good paying enterprise, while the whole tract being a dead level, the cost of construction and the cost of maintenance would both be lighter than usual.

## A MODERN PRINTING ESTABLISHMENT.

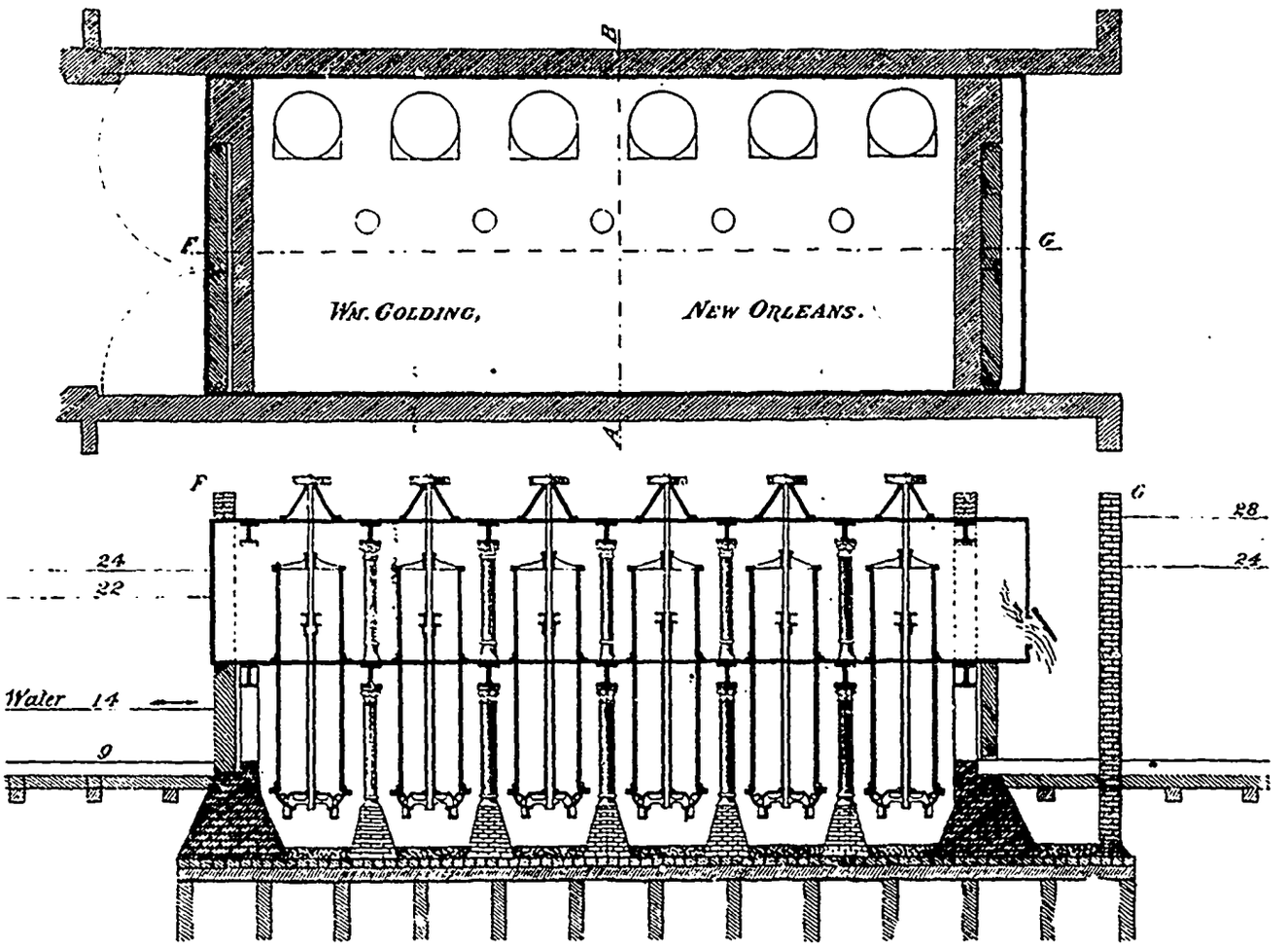
The largest printing establishment probably, in Canada, is that owned by the Methodist Church, and known as the Methodist Book and Publishing House, situated on Richmond street west, Toronto, and having a frontage also on Temperance street. The Richmond street building has a frontage of 100 feet, and is four stories high, besides basement. Here are situated the retail department, the editor's offices, and the offices of the various connexional offices of the Church, a board-room, etc., etc. The Temperance street front extends over 118 feet, on which is a six-story building, with basement, containing engine and boiler-rooms, shipping offices, wholesale book department, bindery, folding, and stereotyping rooms. Connecting these buildings is another structure of four stories, in which is contained the press room, composing room, book stock-room and general offices and a store-room.

In the press room there are eighteen large cylinder presses, two of which are perfecting or double presses, a full complement of Gordon presses for small work, a folding machine, paper cutter, and everything necessary for turning out work expeditiously. The composing room is a handsome and airy apartment, with frames to accommodate about eighty compositors. Two linotype type-casting machines of the latest pattern form part of the equipment. The bindery has the latest and best machinery for turning out all kinds of binding work in leathers and cloths. Here will be found embossing presses, cutting and trimming machines, gilding, sawing, sewing, wire-stitching, backing, and case-making machinery. The stereotype and electrotyping room is complete with dynamo, casting boxes, sawing machine, routers, bevellers, furnaces and all necessary tools.

The buildings are heated entirely by steam. The mechanical departments by exhaust from the engines, the front building, offices, etc., by the low-pressure gravity system. In the boiler-room are two 60 h.p. boilers, made interchangeable for high and low pressure. These are fed by a Northey steam pump. In the engine-room are three engines, two Wheelocks, 60 and 90 h.p., connected to an underground shaft by large belts, and arranged with friction-clutch pulleys, so that either engine or both may be used at any one time. The building is lighted by electricity, generated by a 10½ by 10 in. Ideal engine direct connected to a 30 kw dynamo, which has lately been installed by the Toronto Electric Motor Co. The generator provides current for 650 16-c.p. lamps. From this machine there can be run as well, however, through motors, arc or incandescent lights. The armature of the generator is of the wave-wound type, with ventilated core, the armature being so constructed that no wire passes over the ends. Consequently no dust or dirt is allowed to accumulate. The crown is of heavy iron, with the laminated poles cast in so that the magnetic current is perfect. It is the most modern type yet out, and is the first of the kind ever built in Canada. It has run with a superlative smoothness since its installation. The establishment is protected against fire by two large stand-pipes running from cellar to roof, with hose on each flat attached and ready for use. G. C. Mooring has charge of the steam plant and machinery, and has been with the firm over eight years. He is a chartered member of Toronto No. 1, C.A.S.E., and having always taken great interest in the work of the order, he has recently been elected president of the Toronto Association.

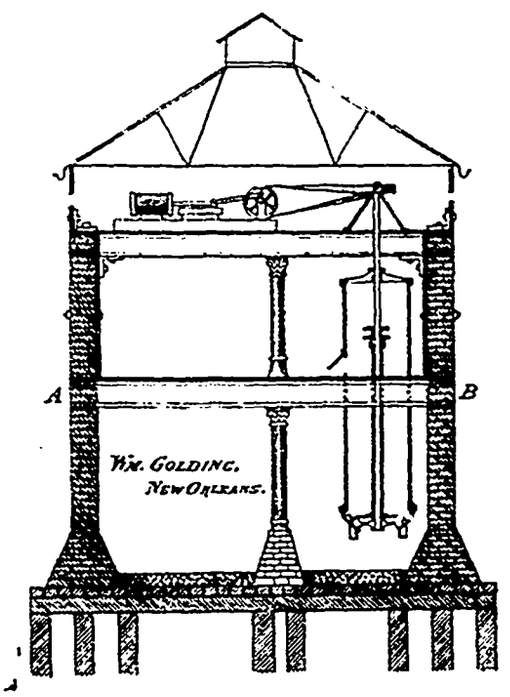
This thriving institution had a humble beginning in 1829, and has attained its present high position by steady and persistent energy, combined with honorable dealing. During the past decade, under the management of the present book steward, Rev. Wm. Briggs, D.D., its growth has been phenomenal, and notwithstanding that it has but recently moved into its present quarters, its expansion has been such that it was found necessary to acquire additional ground to permit of extensions in the near future.

ROBERT JAMIESON, the chief engineer of the West Kootenay Power and Light Company, which is putting in a big electrical plant on the Kootenay River, says work is being pushed in all departments of the enterprise, and the company expects to be supplying power in Rossland, B.C., by December 15.




## PUMPING PLANT.

The accompanying illustrations show a system of pump installation, in which the water is lifted no higher than is necessary to effect the discharge, against the varying surface heights of the out-fall receptacle. Steel beams cross the walls at A. B., upon which is placed a steel tank, through the bottom of which are suspended several centrifugal pumps, which receive




the water from the pit, and deliver it into the tank, from which it flows to the out-fall receptacle. The bottom of the tank is placed on a level with the minimum height of the out-fall receptacle, while the top of the tank will be placed above maximum height of out-fall receptacle.

The pumps will be placed on one side of the tank, in order to form a by-pass for the water to run through without pumping, when the conditions are favorable. On the top of this tank will be erected a suitable building of iron, in which will be placed the operating machinery. It will be understood that if the surface of the out-fall receptacle should rise to line 24, the valve shown at end of tank would close, and would remain closed until the water inside of the tank was raised higher than the water on the outside. The motive power, either steam, gas, or electricity, will consist of a motor for each pump—the object being to start one pump at a time, as the water commences to flow. Where the conditions are such that the maximum height of the out-fall receptacle exists but a small portion of the year, the advantages of this system will be fully appreciated. This pumping system is the invention of Wm. Golding, C.E., New Orleans.

## THE NAVIGATION OF THE AIR.

*Editor* CANADIAN ENGINEER:

Balloons to date have always been symmetrical in cross section, or around on either vertical or horizontal axis of rotation. They have been spheres or spheroids, and when the latter, sometimes oblate, sometimes prolate, that is, elongated as the lemon, squat or flattened at the poles, as with the orange or the apple. They have also been made ovoid, as the egg, and even spindle-like, as the weaver's shuttle; but always symmetrical in any and every section, perpendicular to the axial line.

Thus there has never been an attempt, as with flying machines, to imitate in a balloon the shape of a bird on the wing: and yet there should be, there must be, to be successful in directing them, as man has become in propelling vessels through the water by building them in imitation of the fish. Nor will flying machines ever prove a success until some closer imitation has been arrived at than heretofore, of the winged denizens of the air. These have been supplied with machines which have to perform the double duty, not only of propulsion through the air, but of ministering the while to their buoyancy.

This necessity must be eliminated, and can be, in flying machines, by having a space inclosing structure, approaching in point of weight to that of a more or less perfect vacuum, by

inflation, as is usual, by a lighter gas than air, as hydrogen—some fourteen times lighter, bulk for bulk, than air—and this requiring less place or bulk to do the needful, or with the heavier coal gas, by increasing size of air buoy. Thus, as it is, the balloon is buoyant, but without the proper shape to render it possible to direct its motion, while the sky-flyer is deficient in the opposite sense of having the power of direction without the buoyancy.

Now then, let us try to conciliate or combine the two requirements or desiderata; for as there is so to say but one kind or shape of fish or vessel to navigate the sea, there can also be but one kind of vessel to navigate the air; and the balloon and flying machine as now distinct from one another, must be blended (except for mere ascensional, observational, or meteorological purposes, where the balloon as now made may suit the purpose) into one and the same structure, and as closely as possible approximating to the figure of a bird on the wing.

This may be done by building the balloon or sky-flyer more or less crescent-like, or in the shape of a crescent in its cross section or that perpendicular to its axis of direction. The bird gains buoyancy by plying its wings, spreading them concavely to the air, as a swimmer does with the hollow of his feet and hands against the water which he leaves behind him, and preparatory to another stroke, lengthens out his feet and hands to their minimum cross section to draw (the feet) or thrust (the hands) forward for a renewal of the action; the same again as to propel the boat, the blade of the oar is held flat against the water, and then turned edgeways, pending the interval required for another stroke; or again, the same as with the paddles of a steamer, as soon as they have done their duty in and through the water, they are made to turn edgeways before leaving it, to prevent back-water. This must be done, or no success will be forthcoming. The bird must be imitated, both in its shape and in its motion. Watch it then carefully, look at it from beneath when you get a chance of doing so. We have already seen how it ascends by the ply of its wings. Now it has attained its height, and soars aloft, no more by the motion of its wings or by moving them, but by spreading them, and it spreads the feathers of its tail, till they reach and underlap them, and then you have the surest parachute. The bird, though, must move or soar as it is called, but it does so bodily, or as a whole, now acting as the kite or as the aeroplane, which the slightest motion keeps afloat, either by its own advance in perfectly still air, or by the motion of the air in the contrary direction, when the kite, or bird, or aeroplane, moves against the wind or breeze; and similarly does and must the cyclist move when soaring, so to say, on his wheel, or at a standstill or slow motion, by curving slightly to one side, then the other, to retain his vertical position in space.

But there is another cause which helps the bird to soar on air, and which I do not remember as yet to have seen noticed, any more than does the centrifugal action of floating ice or other objects, such as the remains of the "Jeannette" or other wreckage, appear to have ever been taken into the calculation, or in any way considered as a factor in the computation as well as circum-polar currents, etc., in Arctic navigation.

This is the very heat generated by the bird's body, and we all know how immensely hot a bird feels when you hold him from beneath. This heat then imparts itself by radiation and conduction both, to the air contained in the concavity between its wings, it heats this air and thus rarefies it and makes it lighter, with the tendency, if not to further lift the bird in space, at any rate, to keep it there or on the wing, and prevent its tendency to fall, which it would do, or at any rate, descend, as with an ordinary non heat-generating parachute.

And this soaring of the bird, the bird of prey especially, is due to its meat or flesh-devouring propensities, and of fatty and oily substances creative in the blood of vast amounts of carbon, which, when brought into contact with the oxygen of the air in the bird's act of active respiration, sets fire, so to say, to the interior, with the effect alluded to of thus maintaining its not otherwise-to-be-explained faculty of keeping almost indefinitely on the soar.

Again as in the so-called ball-cock mystery, of which I was the first to explain the apparent paradox; buoyancy, or additional or increased buoyancy might be obtained under a parachute or flying machine of the kind, by causing a jet of steam from a boiler of the propeller, if such were used to give motion to the flyer, or a jet of gas of any kind, or of atmospheric air, to issue from a reservoir of compressed gas or air, or from an air or gas compressor worked by the engine, and either by electricity or any other motive power, to issue from a conical nozzle with a ball near its apex, or from the conic space between two concentric cones, and at such an angle as required to cause the funnel-like jet to pass out in contact with the circular periphery or outer and lower edge of a conical or concave roof or ceiling to the flyer, which (the jet) as in the case of the similarly shaped water nozzle, would, by the mere effect of its friction on the air contained beneath the parachute-like covering, roof or awning, suck the air from the space enclosed between the awning and the funnelled jet of gas or air in a way to form a vacuum or partial vacuum within; and again, in this way be productive of the buoyancy required to float the flyer, and allow of applying the power of its motor or the balance of such power, as the case might be, to the propulsion of the bird-like structure through or into space.

But better still, let the buoyancy be provided for in advance of starting, by making the structure a balloon or space-enclosing one, and let the car and motor be held beneath the balloon in the concavity between its horns, already spoken of, by building it as said, of crescent-shape in its cross section. Its weight might be borne by rods or ties from horn to horn, or it might be suspended to the under or concave side of the aerostat or to suit its height to all requirements, its head might rise air-tight, of course, into the very balloon itself, and be there maintained in shape by suitable light steel ribbing.

Now on either side the car and perpendicular thereto, or symmetrically and at whatever angle, there might go forth axles of motion, and these axles might either pass beneath or through the pendant horns of the crescent, coupled thereto if passing beneath them, or if passing through them, would do so through fixed tubes concentric in direction with that of the axles, and with joints at either end made impermeable to the space-filling medium of the air-ship. Then to the ends of these axles, projecting as required beyond the tubes, would be attached such paddle-wheels or motor-blades as required to propel the ship through space; and by making the axles separate or capable of separate action, the one from the other, both would be made to revolve or work at the same velocity for straight motion or motion ahead in a vertical plane, or one of them to work slower than the other when starting on a tack, or the one backward and the other forward for speedy rotation of the vessel or a change in direction, end to end. And if the tail-end of the aerostat were provided with a rudder, this could be easily worked from the platform of the car by an endless chain or rope passing through sheaves and pulleys attached to the bottom or concave side of the imitative bird, or again a screw or helix,, or a pair of them (twin screws) could be as easily handled from the car.

I have as yet said nothing of the balloon in longitudinal section, nor of its plan or shape as viewed from above or below; but from what I have said about a bird-like structure, it will have been inferred that the rear end of the airship should be like a lobster's tail, and the whole bag of gas fan-like in plan, while its head or nucleus should, except for its concavity beneath, be like that of Newton's great comet of 1680, Halley's comet of 1835, the six-tailed (feather-like) comet of 1744, that of 1811, and even those of by-gone ages, as of A.D., 1006 (supposed to be Halley's, of 1835), are described in the annals of the time as exhibiting a tail in the form of a scythe, as if their mighty flight through space (at a million miles or more an hour when under perihelion influence) as if concavity of the tail while traversing ethereal space, were akin to that formed by birds traversing atmospheric space, or that their heating of the ether in their concave surface had something to do with an ethereal vacuum supporting them in space.

But I had better keep out of ether and get back into air, with the concluding remark that such a shape of balloon cross-section would, in case of collapse or of a rapid coming down, in case of a burst or rent in its enclosing skin, cause it to fall on its horns, which, being made of certain amplitude or thickness and lower rounded edges, as I should have said before, would act as buffers on land and water to deaden the fall or force of impact. The balloon, it is likely, should be ribbed, and all its ribbing and impelling machinery be made again in imitation of the bird, of light steel tubing (birds' bones being hollow), thus affording increased strength with less material, and as such ribbing would, even in case of a burst and escape of gas, maintain the shape and keep the enclosing material in position, this would be highly conducive

to the prevention of accidents, since even without the gas within it, the outspread cotton, cloth, or silk, or of whatever material the coverings were made up, would be sure to stay the velocity of descent and effectively prevent casualties, and here again we take our cue from the bird; for though when, after soaring it perceives its prey, it swoops or shoots down like an arrow, closing its wings and the feathers of its tail the while, but when near the earth it spreads them again to break its own fall, which otherwise would prove as fatal to it as that of a man not armed with a parachute for the purpose of retardation.

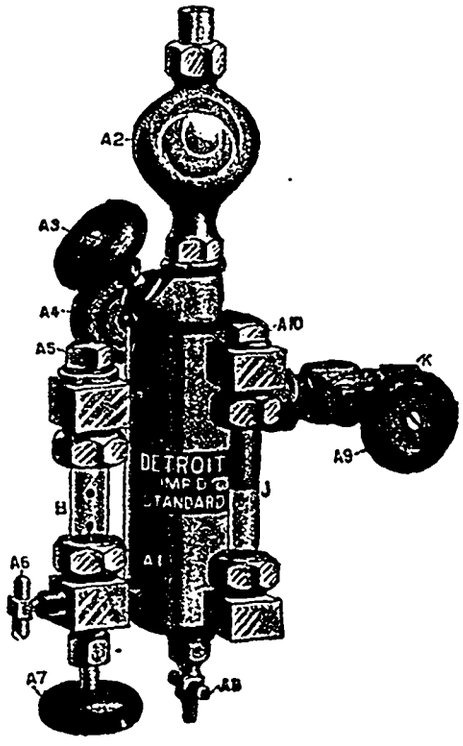
Quebec, October 25th. C. BAILLAIRGE, C.E.

## LUBRICATION OF STEAM CYLINDERS.

Proper cylinder lubrication is a much more prominent factor in the performance of the steam engine than most engineers or engine users suppose. For years its importance has been recognized by the experts, the inventors and designers of high-grade engines, and a more correct estimate of its influence has pervaded the rank and file; still, it will be a matter of surprise to many to learn that with the exception of the initial condensation of steam, the greatest loss about a steam engine is due to the friction of the slide valve and piston.

In their new catalogue, just received from the Detroit Lubricator Co., of Detroit, Mich., is given some very interesting data on this subject. It consists of reports of the results of tests made at one of the most prominent testing plants in the United States, not by the makers of lubricators, but by mechanical engineers, who are purchasers and users of these articles. These tests proved that with a well lubricated slide valve and cylinder, an engine can do 35 per cent. more work than when these parts are not well oiled. That these results are not exceptional, it might be added that they have been approved by a great many of the leading American engineers, and Prof. R. H. Thurston, of Cornell University, in his book on Friction (recognized as the standard work on this subject in engineering circles of the United States and Europe), estimates the loss due to imperfectly lubricated slide valves at from 25 per cent. to 50 per cent. of the energy of the steam used.

Sight feed lubricators are designed to prevent this loss of power. There are different kinds of different degrees of merit,

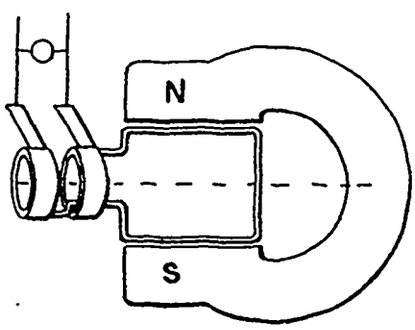



some very crude, and many very thinly disguised imitations of antiquated patterns. As an illustration of the progress that has been made in these devices, we insert cut of the improved standard lubricator for stationary engines, made by the above-named company. In it are included all the improvements and advantages, which in their more than 20 years' experience, they have found to be necessary or desirable. Among these advantages is its heating channel. This extends through the body, between the upper sight feed arm and the support arm, and it is always filled with steam from the steampipe. Thus, no matter how cold the weather, or how heavy the oil, the same number of drops per minute is always maintained, and perfect lubrication assured under all circumstances. The globe valve in the support arm makes it easy to attach, and allows the lubricator to be removed at any time, for repairs or otherwise, without letting down steam. The necessity for repairs, however, is a rather remote contingency, as each lubricator made by this company is tested at a pressure of 300 lbs. before it is allowed to leave the factory. Perhaps the best evdence of the merit and popularity of these goods is the fact that more than 350,000 of them are in use on the engines of almost every country of the globe, so that their motto, "We Lubricate the World's Machinery," is not such an exaggeration as might at first sight be supposed. Our readers will find the new catalogue referred to, to be quite an acquisition to their library, and very useful for reference. It shows the full line of sight feed lubricators, kerosene oil injectors, glass and brass oilers, oiling devices, valves, low water indicators etc., made by the Detroit Lubricator Co., and a copy can be obtained free by addressing the company at Detroit, Mich.

## DIRECT AND ALTERNATING CURRENTS.*

You are all aware that direct or continuous currents are so called from the quality which they possess of maintaining a uniformity of direction of flow with regard to the conductor through which they are passing. Direct currents, however, are not always of constant pressure; but are often intermittent or pulsatory in their character, and under such conditions exhibit many of the characteristics of alternating currents, which are constantly fluctuating with more or less rapidity from a positive value to the opposite or negative value many times in a second. The frequency of commercial alternators varying from 25 to 140 complete periods or cycles per second.

I shall not attempt in the short space of time you have to listen to me to-night to skim over the whole field, but will confine my remarks more particularly to the kind of electric currents the steam engineer is more apt to come in contact with. The rapid strides that electricity is taking makes it important that all should familiarize themselves with the laws governing this subtle force. Most any of you are liable to be placed in a position where you will have charge of one or more dynamos for generating electric current for lighting or power purposes, and it is to dynamo electric current that I shall more particularly refer to-night. I assume that you are aware that metallic substances are good conductors, copper being the best commercially. Also that most other substances are poor conductors, some being such poor conductors as to be termed insulators, such as glass, porcelain, dry wood, paper,



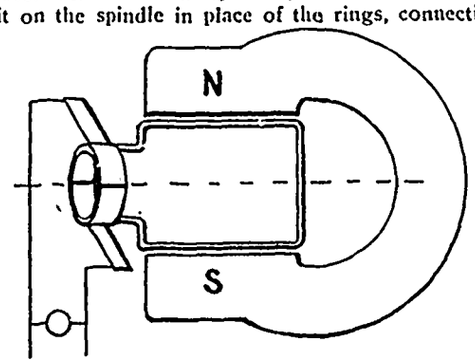

ALTERNATING CURRENT DYNAMO.

and cloth. The great Faraday, who may well be called the father of the electric dynamo, discovered in 1831 that when a coil of wire was made to approach a magnet, an electric current was momentarily established in the coil, as indicated by the deflection of a galvanometer connected in circuit with the coil. This discovery was followed by a series of experiments probably unequalled in any branch of scientific research for brilliancy of perception and clearness of reasoning power. This philosopher, before his death, gave to the world the fundamental principles upon which the dynamos of to-day are constructed.

Starting with Faraday's principle of induction, let us construct a very simple form of dynamo. Take an ordinary horse-shoe magnet, and for simplicity I will show a single

*Paper read before the Canadian Association of Stationary Engineers, Toronto No. 1, by F. H. Leonard of the Toronto Motor Co., 20th Oct.

turn of wire arranged to revolve in the magnetic field, if to the two ends of this coil of wire we attach a pair of rings, and on them place two strips of thin sheet copper for brushes to conduct the current to the outside circuit. We have all that is essential for our dynamo. If in the circuit of this elementary dynamo we place a galvanometer—which is an instrument for indicating the flow of electric currents—we shall find that as we turn the coil about there will be a deflection of the pointer of our instrument, first in one direction, then in the opposite, as the coil in our dynamo assumes first one, then the other position with regard to the magnet. We have produced then an alternating current. If we wish to obtain direct currents, we must change our construction, and substitute in place of our two rings a commutator, which in its simplest form consists of two sections. We will split a piece of tube in two, and mount it on the spindle in place of the rings, connecting one

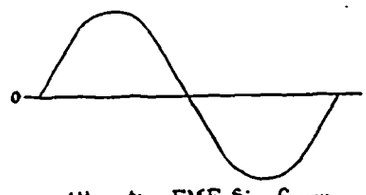



SINGLE COIL DIRECT DYNAMO.

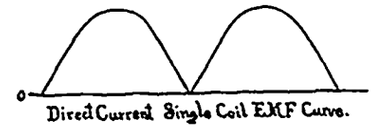
end of our wire to one part, the other end to the other part, insulating the two parts from each other, so there will be no electrical connection between them. Again, we rotate the coil, and we shall find the galvanometer deflection takes place always in the same direction, but comes to zero at each half revolution of the coil. We can represent by a curve just what takes place in the coils or armatures of these two forms of dynamos during the period of one complete revolution. Just as the steam engine indicator represents the pressure at every part of the stroke, so our curve will show the electro motive force at every point of the revolution.

The E.M.F. (electro motive force) curve of our alternating dynamo, starting from a line of zero potential, will rise more or less abruptly, depending upon the design of the dynamo to a point of maximum positive potential, then droop, and passing the neutral or zero potential line, descends to the point of maximum negative potential.

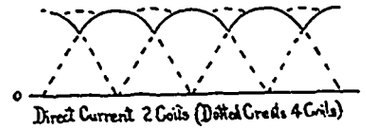
The most desirable form of all-round work, and the one which most modern, well-designed alternators follow, is the sign curve. Though many single phase alternators, which are perfectly satisfactory for lighting purposes, depart considerably from this form and show a peak-topped, and some a flat-topped, curve. The E.M.F. curve of our direct current dynamo differs from the alternator for the reason that the commutator replacing the collector rings slips from under one




Alternating EMF Sine Curve.




Direct Current Single Coil EMF Curve.



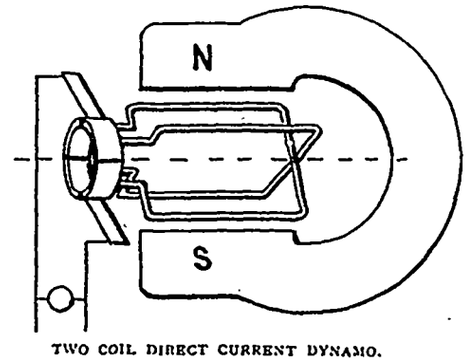

Direct Current 2 Coils (Dotted Curve 4 Coils)

brush to a position under the opposite brush, just at the moment the current in the coil is about to reverse, and instead of descending below the zero line, it again ascends, making in a complete revolution two curves, similar to the first half of our alternating current curve, both of which are above the zero line. Such a curve represents a series of impulses following each other with every half revolution, and would not make a satisfactory current for practical working. Other evils would also creep in, as we multiplied the number of turns to obtain the commercial voltages which would produce vicious and destructive sparking at the commutator.

To obtain a commercial dynamo for direct currents we must then alter our design, and instead of using a large number of turns of wire in a single coil, we must divide these turns into a number of smaller coils, and furnish segments in our commutator to correspond with the increase in number of coils. We will first see the effect of two coils spaced equally around the periphery of our armature with a segment attached to each end of the coils.

Now, if we trace an electro motive force curve from this armature, we shall find that the pressure does not fluctuate so much as with the former arrangement, and instead of dropping to zero at each half revolution, the pressure is always maintained at a point of considerable pressure, for the reason that soon after a coil has passed into a position in the field, where the rate of cutting lines of force is less, the commutator sections corresponding to this coil have slipped from under the brushes, and the sections connected to the other coil have passed under and into contact with the brushes, and supplies the circuit with a fresh E.M.F. rising in potential, the other coil in the meantime is out of circuit or idle. If, instead of two coils we employ a still larger number, we continue the process of smoothing out till we finally get a practically constant pressure throughout the revolution. Also, as we multiply the coils we shall find it desirable to avail ourselves of the E.M.F. generated in the coils, which are not in a position of maximum potential, and utilize the potential of coils rising to maximum and descending to zero; this will also materially reduce the sparking at the commutator. Thus, all the coils in a commercial dynamo are connected together, and loops taken to the segments of the commutator, except in a few cases, notably the Brush arc dynamo.

So far the dynamos we have been considering have been constructed without iron in the armatures, but as iron is a much better conductor of the magnetic lines of force, which are depended upon to induce the E.M.F. in our coils, it would evidently be better to introduce an iron core into the structure, thus reducing the reluctance of the magnetic circuit. Also we have used a permanent horse-shoe magnet, whereas we can obtain a much more dense and powerful magnetic field by using an electro magnet, which may be obtained by passing the electric current through a coil of wire surrounding an iron core. The shorter and thicker we can make the magnetic circuit, the less energy there will be required to produce the magnetic field, and wide air spaces are to be avoided, as they offer serious resistance to the flow of lines of force through




TWO COIL DIRECT CURRENT DYNAMO.

the magnetic circuit. Part of the electric current generated by the dynamo itself is generally utilized to excite the field of direct current dynamos, though alternators are usually separately excited by a smaller direct current dynamo. What applies to the magnetic circuit in a direct current dynamo is equally true in regard to an alternating current dynamo. Care must of course, be taken, to insulate the copper of the electric circuit from the metal which is used for the magnetic circuit, as well as to insulate the various turns or convolution of the electric circuit from each other, so as to avoid short circuits.

From what has been said, I trust you have been able to form a fair idea of the manner of obtaining both alternating and direct currents by means of the dynamo electric machine,

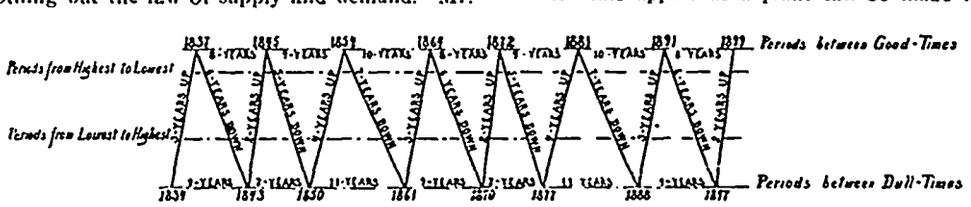
which is only a piece of apparatus for transforming the mechanical energy of the water-wheel or steam engine into electrical energy. There are several types of direct current machines, but they can be divided into two principal classes—constant current dynamos and constant potential dynamos. The constant current dynamo is used principally for arc lighting, the flow of the current remaining fixed while the E.M.F. increases as the arc lamps or other devices are added in series. The constant potential dynamo is the type generally used for incandescent lighting and power purposes. This type of dynamo is designed to maintain a constant E.M.F. or pressure, and the current is increased as lamps or motor are added to the circuit in multiple Alternators are also built for constant current and constant potential, though the former are not much used at present.

Direct currents are generally used at low E.M.F., 110 to 125 volts being common for lighting plants, though in arc dynamos the pressure in the larger sizes reaches as high as 8,000 volts. At 110 to 125 volts, of course, large conductors would be necessary to supply any considerable amount of energy, which necessarily confines this type of dynamo to limited areas, so the work can be reached without too large an expenditure for copper conductors. The alternating currents, however, on account of the facility with which they can be transformed from a high to low voltage or vice-versa, without the necessity of any moving parts in the transformers or convertors, as such devices are called, are generally used for transmitting energy to greater distances, and for distribution covering areas of many miles, the Niagara power being transmitted 26 miles to Buffalo by alternating currents generated by 5,000 h.p. two phase alternators at 2,000 volts transformed to three phase alternating currents at 10,000 volts for the transmission and at Buffalo transformed from 10,000 to about 340 volts alternating, which is then transformed by rotary transformers into direct current at about 550 volts for supplying the street railway motors. As can be seen from this instance, the flexibility of the alternating current system is wonderful, particularly when it is understood that these transformations take place in the static transformers with a loss of less than 2 per cent. for each change, the greatest loss for any change being in the rotary transformer, and even this is obtained at an expense of about 5 per cent. Under the high pressure alternating currents are transmitted with allowable loss and transformed to the lower and safer pressures on the spot where the current is to be utilized. It is difficult in so short a space to give much of an idea of either direct or alternating currents, not to mention their differences, but have tried to touch on a few points, which I hope will awaken sufficient interest to bring about a deeper study of the subject.

## PIG IRON AS A TRADE BAROMETER.

It was Lord Beaconsfield who pointed out that the chemical market was an indicator of the trade conditions of the world. When chemicals were active, trade and manufactures flourished, and when the chemical market was depressed, trade languished. F. S. Evans, of the well-known bicycle firm of Evans & Dodge, Windsor, Ont., shows that pig-iron is even better than chemicals as a trade barometer, as it is the only great staple that is affected by nothing but the law of supply and demand. Mr. Evans has, with great patience, worked out the accompanying graphic table, showing the fluctuations in pig iron back to 1834, these being taken from American prices current, as quoted in the markets and trade papers. It is remarkable with what exact regularity the periods of high and low prices recur, not only in these short cycles, but in the long cycles. For instance, taking the range of highest prices, we have a long cycle of eight years, nine years, and ten years, recurring in the same period as time goes on; and in the lowest points there are similar periods of nine years, seven years, and eleven years, which are repeated in regular order from 1834 till now. Projecting the lines forward into the future, we find that prices will continue to rise till they reach their highest point, in 1899.

It may be noted that the present tendency of prices in pig iron confirms the correctness of Mr. Evans' instructive table.




## EVAPORATIVE CONDENSER OR COOLING TOWER.

Recently President E. J. Philip lectured before the Hamilton branch, C.A.S.E., on this subject. The substance of his remarks was the same as his paper read at the Brockville convention, and published in full in the September number of THE CANADIAN ENGINEER, with some additional explanations and matter, bringing the discussion up to date. We append the portions of his lecture not found in previous numbers, the whole making a complete statement of the question:

The evaporative condenser or cooling tower is made to operate where the supply of water is limited, or where it has to be bought. This apparatus is in every way the same as an ordinary condensing plant, except that in addition to the air-pump and condenser there is a tower for cooling the water after it has been heated by condensing the steam. Its construction will be taken up later on.

This apparatus is the outgrowth of the increasing number of steam power plants in recent years, with vastly increased h.p. capacities, which has of necessity raised the price of the lower grades of coal. Whenever fuel goes up in price, or where the quantity is increasing, due to increased load, the steam user begins to look around for some means of reducing the rising fuel account During the last few years, engineers have had every opportunity to put in what may be called "ideal plants," and others have had the opportunity to improve the plants under their control. How far many have succeeded is known only to themselves; if any part is a success it becomes known, and is copied or improved on. The principal improvements during the last few years have been due to higher steam pressures, increased number of cylinders, and where water was at all available, running condensing; and the absence of water in sufficient quantity to use for condensing purposes at a point where it is desirable to locate a power plant, has caused it to be located at some remote or less desirable point, the necessity of having water for condensing purposes being recognized as leaving no alternative. The cost of running condensing and using water from a city main is out of the question, as it costs more for water than is gained by condensing: this being the case, it formerly left no alternative but run non-condensing, or build the plant where there was an abundant supply of water without regard to the disadvantage of the location.

This has been overcome by improvements in an apparatus that has been used for years in a crude form for other purposes. The first purpose it was used for was for cooling water that had been used for cooling beer. This form of tower was simply a square frame work, filled with brush or limbs of trees, the water was pumped to the top through a sprinkler, and in falling over the loose brush it spread out in thin sheets over the surface of the wood, and was acted on by the air, the warm water causing a current of air to circulate through the filling. The present tower is simply an improvement on the original form, and when used in connection with a steam engine it takes the place of a natural source of water supply. With this apparatus a plant can be made to run—condensing, with less water than it can run non-condensing. The reason of this I will explain after a description of the tower, which will now be in order: The cooling tower is usually square or rectangular in form, but it is sometimes made round, and is filled with partitions. The partitions may be made of any material. The Worthing tower is filled with tile, the Barnard tower is filled with wire netting, the Gradier with wood, and sheet iron has been used by different parties. Any material that will give a large surface will do, the object of the partitions being to spread the water out in thin sheets over the surface. The partitions do not extend to the bottom of the tower, but a space is left below them into which a fan discharges air. At the top of the tower a distributer is attached

to distribute the water over the partitions. Now, the action is this: Imagine an engine running condensing, and taking its injection water from the bottom of the tower (into which a quantity is put when the tower is first started). Now, when this water has condensed the steam, and passes on to the air-pump, instead of the pump discharging the water to the sewer, it discharges it to the top of the tower into the distributer, where it is evenly distributed over the filling. It spreads out in a thin film or sheet, and passes slowly down the partitions. The fan is running, and its air is passing up between the partitions, and acts on the water in two ways, thereby cooling it by the time it reaches the bottom of the tower sufficient to again condense more steam. The way in which the water is cooled is: First, the water looses some of its heat by radiation from the piping between the tower and condenser, also from the sides of the tower. Next, the air is raised in temperature, carrying off heat in this manner, and the last, and by far the greatest cooling effect, is obtained by the air evaporating a certain quantity of the water, carrying off heat in the vapor as latent heat.

I made the statement that with this apparatus a plant can be run, condensing, with less water than it can be run non-condensing, and I will try and prove this. Take an engine running non-condensing, and using, say 25 pounds of steam per h.p. per hour, and taking its water from the city main; if it is, say 100 h.p., it will use 2,500 pounds per hour. Now, this water is being exhausted out into the air in the form of steam. If we attach a condenser and cooling tower to the engine, and it saves at the engine, say 20 per cent., the engine will use 20 per cent. less water, which will make the water consumption 20 lbs. per h.p. per hour, or 2,000 pounds per hour for the 100 h.p. When condensing, instead of the water passing off as exhaust steam, it is pumped into the cooling tower, and for every pound of water evaporated by the air, sufficient heat is carried off to cause a cooling effect sufficient to condense one pound of steam. If all the cooling effect that took place was due to evaporation, there would be water neither gained nor lost, as there would be as much evaporated as condensed, but as I said before, a certain cooling effect by radiation takes place, and the water cooled in this way can do the work of cooling, and is not evaporated. Then the rise in temperature of the air carries off considerable heat without evaporating any water, so that between these two, sufficient water is saved to cause a slight overflow from the tower all the time, and as the boilers are using 20 per cent. less water, it follows that in this way you are running condensing with 20 per cent. less water than you can run non-condensing.

The tower that was built this summer where I am employed is a rectangular structure, 19 feet high, with a vapor stack on the top, 9 feet in diameter, and 26 feet high; the body of the tower is 10x12. It has an 18-inch water space at the bottom, and two five-foot fans. The filling is 12 feet long, and principally wire. The distributer is made of pipe, and works very nicely. The tower runs in conjunction with a 500-h.p. surface condenser, with combined air and circulating pumps, built by the Northey Co., of Toronto. The condenser has 800 brass tubes 8 feet long, making over a mile of tubing, with 1,600 stuffing boxes. The water leaves the condenser at from 120 to 128 deg., and is cooled by the tower to from 68 to 90 deg., according to the amount of air. It is possible to get almost any cooling effect by varying the quantity of air; the water has been cooled to 60 deg., with the outside temperature at 78 deg.

## DYNAMO TROUBLES AND HOW TO OVERCOME THEM.*

With modern uses of electricity, the increase in the demand for light and power has, in many cases, proven too much for modern power stations to meet. These plants, installed ten or fifteen years ago, when the general application of electricity to purposes of illumination first became evident, have now become obsolete or so far behind the times as to be unable to furnish a satisfactory service. These same installations under ordinary circumstances, to the uninitiated, apparently give perfectly satisfactory results, and the question is often asked by directors of companies, "Why purchase new machinery when we are filling the bill with the old? We have had a few mishaps, it is true, and the power has been shut off for a short time now and then, but what does it matter if we do stop for a few minutes, or even hours, if we give all that is necessary during the rest of the time?" Now the consumer of the present day when he pays for a thing expects to get it. It is so with the man who is depending on the electric company to light his house or to furnish power to run his shops, as the case may be. It is in nine cases out of ten that the power is shut off at a critical moment; hence it is that these companies with obsolete machinery fail to keep their customers, many of whom feel compelled to install the more isolated plant.

With the introduction of so many of these isolated plants it becomes necessary for the stationary engineer of the present day, who is called upon to take charge of dynamos and motors in connection with his engineering duties, not only to be posted thoroughly as to the care and running of his engine and boilers, but to be somewhat of an electrician as well. Many times he is compelled when he takes a position to run chances of the machinery not getting out of order, and how often is he censured for the apparatus getting out of order when the injunction has been laid against him not to meddle with any portion of the machine or its adjustments. No engineer can take charge of an engine and boiler until he has passed a thorough examination as to his fitness. Still machinery, far more delicate and liable to get out of order is forced upon him. A mischievous person with a little smattering of electricity can give him no end of trouble, when if the engineer thoroughly understands the machinery he could easily locate or determine the cause.

It is not essential that he should cram his head full of the theory of that "mysterious force," but he should endeavor to post himself thoroughly as to the care and running of any electrical apparatus which may be placed under his charge. The modern dynamo is, as a rule, a well built machine, and if proper care be taken should require very little attention; but accidents will happen, and many dollars have been lost through the engineer not knowing what to do in case of an emergency. I will therefore endeavor to give you a few hints as to the care of a dynamo, and an idea of some accidents which are likely to occur, and the best way to look for and repair the same.

To begin with, the position of the dynamo cannot be too well looked after. More often than not, little consequence is attached to this important point, the dynamo being pushed into some dark, out-of-the-way corner, where not only is it next to impossible to see, should anything go wrong, but where it cannot be kept clean. It is most desirable that the position chosen should be in a cool, dry place, free from dust, where the machine can be readily seen and of easy accessibility. This condition is not difficult to fulfill, and the engineer will benefit by it in the end. Plenty of room on all sides should be allowed, as it is not the most pleasant thing in the world to handle in cramped quarters a dynamo which may be running at a high rate of speed and voltage. In choosing a place for a dynamo the switchboard must not be forgotten. It is true that there may be but one switch and fuse block, but it is important to have them where they can both be seen and reached without loss of time. If possible place the switchboard and dynamo where they and the engine can readily be seen from one point, and where in case of emergency, they may be reached with the least possible delay. For instance, if a fuse blows, it ought to be in a position where it would be quickly noticed. The chief object in selecting a place for the dynamo which is free from dust, is that dirt is one of the electrician's greatest enemies, and it can safely be said that over fifty of the so-called diseases of dynamos may be attached to this cause. A dynamo, in fact any kind of electrical apparatus, cannot be kept too clean. In cleaning, not merely a general wiping is necessary, but a thorough inspection of every part, for it is the dirt in the out-of-the-way corners which gives the trouble.

*Commutator.*—In cleaning and inspecting a dynamo, perhaps the most important part to be attended to is the commutator. This, if it has been properly looked after, should have a dark polished surface, and every effort should be made to keep it in this condition. This can only be acquired by cleanliness and proper adjustment and care of the brushes. First—See that no dirt has lodged between the segments, or between the lead wires where they join the commutator bars. (A stiff dry brush is useful for this purpose). This is important as many an armature coil has been burned out owing to short-circuiting at the commutator, caused by dirt or copper-dust accumulating at the points mentioned. Secondly—The commutator may be running sparkless and no fear of trouble suggest itself to the engineer; when the machine is stopped, however, careful inspection may show signs of burning along the bars. This should be remedied at once, for if allowed to remain, the result will be badly sparking brushes and development of flats in the commutator. A fine file should be used to smooth the burnt parts, or if too far gone the commutator should be slightly burned down. This latter practice is nearly always necessary in the case of flats It is difficult to explain just how these flats occur; three or four causes are possible: (*a*) One of the bars may be of softer copper than the rest, and so wear away faster; but this is not likely. (*b*) A partial disconnection in the armature at the part connected to

* Paper read at the meeting of Hamilton No. 2 C.A.S.E., Tuesday night, October 12, 1897, by Percy Domville, of the Westinghouse Company, Hamilton, Ont.

the particular flat bar, will cause a spark at every half revolution, so biting away the bar. The trouble in this case will in all probability be found where the lead wires join the commutator. (c) Another cause of flats is a badly balanced armature, which, vibrating badly when running, will cause the brushes to jump and spark, burning away one or more of the segments. If the commutator is a new one, particular attention should be paid to keeping the segments firmly held in position This can be done by tightening the nut or nuts at the end of the commutator. The commutator should be frequently smoothed with fine sandpaper, and oiled until a finely polished surface is obtained

As before mentioned, the proper adjustment of the brushes plays an important part in the care of the commutator. There is no part of the dynamo that will give the novice more trouble than the brushes, and here again let me impress upon you the importance of cleanliness. A clean well-trimmed brush, properly adjusted in its holder, screwed down to bear against the commutator with just sufficient force to prevent jumping and consequent sparking, and yet not so hard as to cause excessive wear, should give little trouble, provided the commutator is in good condition See then that each brush is properly trimmed, that is, cut square across, and if copper, filed off at the proper bevel. If carbon, the brushes should first be placed in the brush holders, and a coarse piece of sandpaper inserted between them and the commutator Then by rocking the rocker arm, the brushes are worn away to the shape of the commutator.

There is no general rule for the thickness of brushes, but one and one half the thickness of the commutator bar is near the mark. The object is to have the brush wide enough to short circuit each section of winding for a brief time, in order that the current may be reversed. The power of the entire machine being dependent of course upon the principle of a rapidly opened and closed circuit creating an induced current, it is much easier to go astray in the thickness of brushes when copper is used, as the angle at which they are set is apt to vary. A very good practice is to make a cross-section of the commutator and brush holder full size in this manner. Then by drawing in the brush, the proper angle can be found, and a piece of wood the shape of the brush can be cut for a template In adjusting the brushes in the holders, take care that all the leaves, if copper, are in contact the whole width of the brush; if not the result will be a spark, and the longer the machine is allowed to run in this condition the worse it will get This can be prevented by marking the length on your template and making a gauge to set your brushes to. The same care should be taken to see that the brushes bear on precisely opposite bars of the commutator, or, if a four-pole dynamo, that they bear on bars that are a quarter of a circumference apart. A very good way is to mark the commutator bars with a centre punch, so that this adjustment may be verified. Having properly cleaned, trimmed and adjusted the brushes, seeing, of course, that they are all firmly screwed to the holders, they should be raised from the commutator by the hold-off catches and left in this position ready for running.

Outside of the commutator and brushes a general cleaning up is necessary Remove all traces of dirt from the frame, looking carefully over all insulators of brush holders, binding posts, switches, field coil ends, etc. Also between the armature and pole pieces inside the pulley and around the foundation. Turn the armature round by hand to see that nothing catches and no loose wires or waste are adhering to it, and none of the binding wires are loose See that the oil cups are full and drip properly If self-oiling, see that the oil wells are full Then, seeing that all terminals are screwed down tight, the dynamo is ready to run Just a word about starting the dynamo. First run your machine with the brushes raised and main switch open, to see that all is right mechanically. Before closing the main switch make sure that the voltage is correct and brushes do not spark. To correct the latter fault, rock the brushes forward or backward till a sparkless place is found; then close the main switch I might here mention that it is also important to see that all dirt is removed from the switchboard and connections. Examine and clean occasionally the field rheostat contact and contact shoe.

It would take too much time to go into all the details of the mishaps and breakdowns which are likely to happen in the running of a dynamo, but I will mention a few most likely to occur:

*Burning Out of Armatures*—It is almost impossible to give any definite rules for the prevention of the burning out of armatures, owing to the probable cause of the trouble being difficult to foresee. Still there are a few points which should be remembered in this connection. As before mentioned, short-circuiting at the commutator is one cause Burning of insulation under the binding-wires will short-circuit the conductors. Short-circuiting in the armature itself is another cause which cannot be foreseen All that can be done is to let the coil burn out and repair it afterwards In drum armatures, and in those forms of ring armatures, which are so connected that the windings cross one another, this evil may occur in consequence of the abrasion of the insulation. Short-circuit between an imperfectly insulated wire and the iron core beneath it is again a fruitful source of trouble.

*Field Magnet Coils*—As a rule field magnet coils give little trouble, but when they do the difficulty is hard to locate, owing to their compactness. Disconnections and short-circuits are most common When there is a disconnection the machine will probably refuse to excite itself. To make sure, the coils should be disconnected at the ends and tested. A common electric bell will tell you if the wire is continuous. If the wire is broken below the surface, the only way to get at it is to unwind it. A short-circuit between any two of the windings will have the effect of keeping the short-circuiting part cool, whilst the rest is hot. The coil may be short-circuited on the frame, which can be tested with the bell.

*Sparking Brushes*—Any of the following will cause sparking brushes: Copper or carbon dust between sections of commutator; copper or carbon dust, or oily matter on brush-holders, causing leak to frame; open circuit in armature, overload, brushes not at neutral point; brushes covering too many segments; brushes not making good contact or loose in brush-holder; flats in commutator; too weak a field wire of armature touching pole pieces.

A dynamo that has been giving little trouble suddenly ceases to generate. On examination everything is apparently in good order, and yet it is impossible to get a spark from it. First look for an open circuit. This may be done with the electric bell, although it is not always a sure test, as a ring may be obtained when a wire is broken and held together only by insulation. Here dirt may play an important part. Look closely for it under the coupling screws, binding posts, and between the brush-holder and brush-holder rod. A very small particle may be responsible, as the following will show: An arc-lighting dynamo ceased to generate in the manner mentioned. By short-circuiting the brushes it was found possible to obtain a flash, while outside of the brushes this was impossible. It was plain, then, where the trouble lay. The brush-holder had already been examined, but on again looking, one of the insulators was found to be charred close to the rod for about an eighth of an inch. This was caused by dirt lodging between the insulators and brush-holder. It was little, but enough to grind the brush-holder on the frame. Other causes for machines failing to generate are explained as follows. A dynamo standing idle for some time may fail to light when wanted, through a wire in the field circuit being broken and held together only by insulation; or after the connections have been taken apart for the purpose of cleaning and put together again, trouble has been caused through crossing connections to the field. An expert leaves an engineer in charge of an arc machine, and is called back without loss of time, as the machine will not work, and he finds the switch open in the field circuit. When closed, the trouble ceases—in this case the trouble being caused by a matter so trifling as to escape the mind of the instructor.

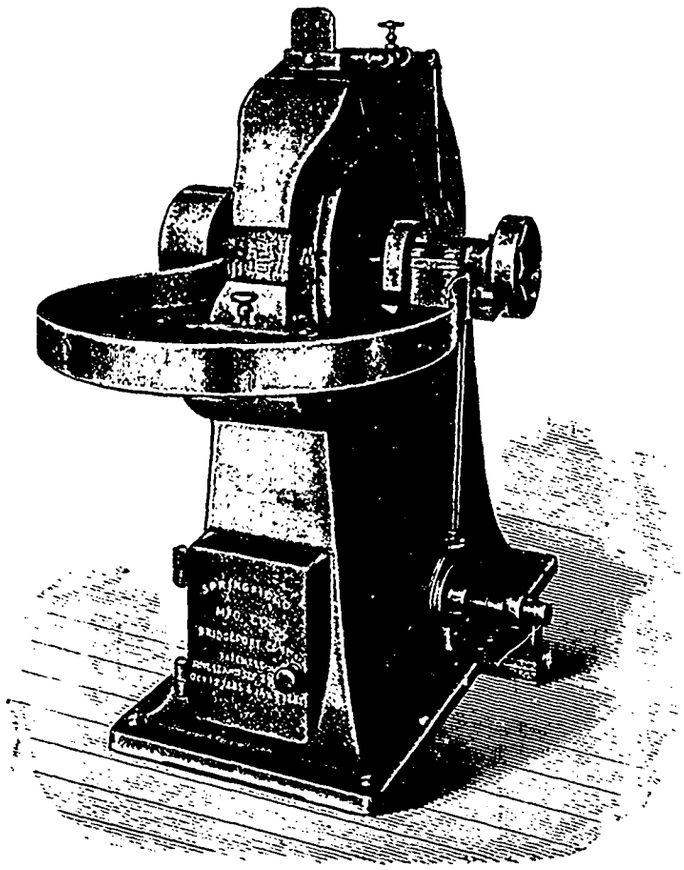
During a thunder storm a flash was noticed at a dynamo, following a vivid flash of lightning, and immediately all lights went out. The dynamo field refused to generate, giving the engineer in charge the mistaken idea that it was burnt out. On investigation it was found that the flash had been caused by one of the binding posts short-circuiting on the frame, the result of lightning striking the line. An engineer after cleaning the brushes of a dynamo could not obtain a spark from it. He had forgotten to screw the lower brushes against the commutator. Another, after hunting for a long time, took the cover off the fuse block and found the fuse blown. These experiences, likely to be met with at any time, with any dynamo, are worth remembering These are a few of those difficulties which will come to everyone in the responsible position of electrical engineer. There are many points about every machine which should be carefully watched, and faults to be remedied before they become serious There is much than can be gained by experience, but a conscientious worker giving all his mind to his duties, will find himself the gainer, for each day's experience will teach some new point, and what is learned in this way is not soon forgotten.

## THE DAVIS BOILER.

The Davis boiler was fully described in THE CANADIAN ENGINEER for June, 1896. This boiler has been put in several boats, with such results that the builders say there is no better boiler on the market. They are tested to 400 lbs. cold water. The great merit of this boiler over other similar boilers is, that there are pots on both sides of the fire, each pot holding one gallon of water close to the hottest fire. There is a strong prejudice against pipe boilers in Canada; but it is fast disappearing as they become better made and better known. The demand for them is increasing yearly, and the British Government is now using them in naval construction.

## TOOL GRINDER.

The above cut represents a tool grinder using a 36 x 4-inch emery wheel. This machine is used for sharpening tools, and has many advantages over an ordinary grindstone. It occupies less space; the men stand nearer the wheel, and are thus enabled to do better work, the apron being sufficiently large and deep to keep the water from the floor. An iron tank, easily reached, is placed under the wheel to receive the water coming from it and catch the waste ground off, which settles to the bottom, and when sufficient collects the tank can be



quickly emptied. The water overflows from this tank comparatively clean into a second tank, to which a centrifugal pump is attached and piped to carry the water to the wheel, where a valve regulates the flow to the desired amount; the pump, being piped to the latter, leaves the first tank free from pipe connections, so it can be easily handled. This is an important feature. The emery wheel is surrounded by a floating hood, except where the grinding is done, which prevents the water flying off, and is quickly adjusted to the wheel as the latter wears away. Water is carried by a small iron pipe, and evenly distributed on the wheel. Weight of the machine, about 2,250 lbs; height from floor to centre of spindle, 36 inches; length of self-oiling bearings, 8 inches; diameter of spindle, 2¾ inches; spindle pulley, 12 x 5½ inches; floor space, 24 x 48; driving pulley on countershaft, 16 x 5½ inches; speed of emery wheel, 375 to 425 revolutions per minute. Similar machines are manufactured with the following size wheels: 12 x 2; 14 x 2½; 20 x 3; 26 x 4, and 30 x 4. These machines are constructed with safety collars and special wheels with large holes, which make the price of the wheel nearly as cheap as an ordinary grindstone. The Springfield Mfg. Co., Bridgeport, Conn., special tool makers, are the manufacturers of this machine, and will be pleased to furnish further information.

## STREET PAVING IN TORONTO.

The change in the popular mind in regard to paving materials is shown by the rise and fall of the cedar block in Toronto and the present popularity of brick. The city engineer's report, just issued, contains a number of interesting tables. The present percentage of the various classes of pavements is as follows:—

| | Per Cent. |
|---|---|
| Cedar block | 42.23 |
| Stone and scoria | .31 |
| Asphalt | 5.67 |
| Wood on concrete | .21 |
| Macadam | 15.43 |
| Unpaved | 30.98 |
| Cedar block with asphalt between tracks | 2.47 |
| Cedar block with brick between tracks | 1.92 |
| Macadam with stone sets between tracks | .27 |
| Brick on concrete | .51 |
| | 100.00 |

Total ..... 257.40 miles.

In 1881 there were only 116.85 miles of streets in Toronto, and of this total 63.39 miles, or over half, had no pavement of any sort; were, in fact, mud roads. Of the balance 51 miles were macadamized, and only three and a half miles were paved with cedar blocks, the best material then in use, with the exception of a few feet of stone sets laid as an experiment. In 1882 the cedar block craze began, and the mileage of cedar blocked streets rose to 13.41. This was doubled in 1883, and the increase thereafter till 1891 was extraordinarily rapid. Here are the figures of cedar block mileage in use for those years:

| Years. | Miles. |
|---|---|
| 1884 | 33.76 |
| 1885 | 39.84 |
| 1886 | 48.89 |
| 1887 | 64.11 |
| 1888 | 79.55 |
| 1889 | 92 29 |
| 1890 | 109.57 |
| 1891 | 116.83 |
| 1892 | 116.86 |

Between 1883 and 1890 the mileage of macadam was reduced from 54.27 to 36.63, largely by the tearing up of the latter material to make way for a pavement that is neither so healthy nor of such lasting qualities. The failure of cedar was made plain about 1890 and 1891, and since that time, notwithstanding renewals of block pavements on streets where property could not stand a more expensive pavement, the mileage of cedar paved streets in use has fallen. In 1892 it was 116.86, in 1893 112.19, and in 1896 108.70, while this total has been materially reduced during the present paving season. Asphalt was introduced in 1887, when a small strip was laid on Bay street, between Front and King. Jarvis street was paved next year, and the experience was so satisfactory that the asphalt mileage of streets increased from one-quarter of a mile in 1888 to 14.61 miles in 1896. Some of the streets, like Bay and Jarvis, laid almost ten years ago, are still in splendid condition, and will last a long time yet without renewal of the wearing surface Macadam is again being laid extensively, the mileage having increased from 34.98 in 1893 to 39.71 in 1 96. Vitrified brick for paving between the street railway tracks was introduced in 1893, and some five miles of it is now in use. As a material for the full width of the street it was introduced in 1895, and about a mile and a half was in use at the end of 1896. It is now being laid very extensively on gravel foundations on residential streets. The general position of affairs will best be shown by comparing in miles the amount of each of the leading materials in use in five year periods since 1881:—

| | 1881. | 1886. | 1891. | 1896. |
|---|---|---|---|---|
| Cedar | 3.51 | 48.99 | 116 83 | 108.70 |
| Asphalt | .... | .... | 6.66 | 14.61 |
| Macadam | 50 92 | 47.36 | 36.39 | 39.71 |
| Brick | .... | .... | .... | 1.32 |

## AN ISOLATED SEWAGE DISPOSAL PLANT.

*(From a Correspondent.)*

The summer hotel at Penetanguishene is situated on the foreshore of an arm of the Georgian Bay, and is equipped with the latest and best sanitary appliances, including a sewage disposal works, containing several of the latest improvements in the sewage filtration. What these new departures in sewage treatment are, is fully explained in an article on sewage disposal commencing on page 128 of the September number of THE CANADIAN ENGINEER.

I am told that often there are as many as 300 boarders, and when that is the case there will be about 4,500 gallons, or 15 gallons per head, per day, of sewage discharged, 95 per cent. of which will be discharged between the hours of 6 a.m. and 8 p.m. This will make the amount of sludge or settlings in the settling tank about 450 lbs. per day, or 1½ lbs. per head, probably reduced to one-half by decomposition. This will have to be removed, though it is composed of 90 per cent of water and only 10 per cent. of solids. I propose to describe this Penetanguishene sewage works, because there are in it some points that are unique, as well as efficient in their application, and suitable in our climate for the proper working of the system all the year round, if necessary.

At Penetanguishene, only pure domestic sewage from water-closets, baths, basins and dish water is handled; storm or rain water being very properly excluded. Suitable provision is made to extract the grease from the dish and washing water discharged from the kitchens before it comes to the junction where the waste pipes con-

nect with the main drain. This is a very important and useful arrangement, because grease destroys the efficiency of drains and sewage disposal works. See remarks on the subject of grease, on column two, page 129 of the September number. After the sewage from all parts has been gathered together, it is discharged into a 350-gallon settling tank. (This is somewhat too small for so many people.) This tank has a discharge pipe in the centre, enabling the sludge to be drawn out into a barrel or wagon that may be so constructed that no offensive smell can be observed. When the hotel is working at its full capacity a half ton of sludge may need drawing out every week, but those taking it out can tell best when the thick sludge is drawn off. It is a great detriment to the working of this disposal works that the settling tank is compelled to be so near the house, which causes the paper and excrement from the w. c. to enter it without any chemical change or decomposition having begun, and the process of dissolving paper and excrement into a liquid has to commence in the settling tank, in place of the drains, which is generally done in town's sewage. On sanitary grounds, it would also be unwise to use screens or sieves before entering the tank, because they would catch all the solids just as they are discharged, and the screens would be rapidly choked, and be very offensive to empty and clean.

To overcome this difficulty the whole is allowed to drop into the settling tank, and to prevent it accumulating in one place or becoming a solid mass, a couple of rakes are connected to a central shaft which can be turned round and thus agitate the mass, causing it to more easily dissolve. Of course the stirring should only be done the very last thing of any night, so that the sludge will have time to settle before much of it can overflow into the syphon tank, and never less than four hours prior to opening the valve to run the sludge out, because in that case only very watery sludge could be drawn. From the settling tank the clear sewage is overflowed into a syphon tank which discharges its contents over on to the irrigation filter every time the quantity accumulates to the amount of 400 gallons.

The sewage when discharged from the syphon enters a conduit 87½ feet long which runs the whole length of the irrigation filter, having a branch pipe on each side every two feet, which thoroughly distributes the cleared sewage equally over the surface of the filter. At the bottom of the filter bed there is a similar set of drains to collect the purified effluent and to convey it into the bay. The conduit and distributing pipes are placed about 15 inches below the surface, carefully buried and covered with gravel and sand, the whole topped with sods, which prevents any smell arising, and if the works were used in winter it would also prevent any injury to the filter from severe frosts. A thorough explanation is given in the September article, showing why and how all filters purify sewage; proving that it is not the filtering material that does the purifying alone, but the microbes and bacteria that lodge in it, and that an ample provision of air should always be made to revivify and aerate all filter beds, so that the microbes can secure plenty of oxygen, and discharge the hydrogen they evolve. Particular attention has been given to this requirement at Penetanguishene, and though the surface of the irrigation filter bed is nearly air-tight, or will be when the sods get well knitted, air flues are so arranged that an abundant supply of atmospheric air can be drawn in as needed.

It will be noted that the flushing machinery discharges 400 gallons every 1¼ hours during the day, and nine hours during the night. It will take about thirty minutes for each flushing to pass down through the sand and gravel filter. When passing down and through the filter it is forcing the air the gravel contains downward before it, and a fresh supply of air follows on after the sewage. Thus, the filter is revivified and aerated after each flush, and after each flush it takes a rest for 45 minutes during the day and 8½ hours between each discharge during the night, which should keep the microbes in a healthy condition and ready to do their work. The filter, or what may be properly called an artificial irrigation land filter, is 85 feet by 40 feet, 377 square yards or about 1¼ yards to clean the sewage from each inhabitant when the hotel contains 300 persons, giving about 12 gallons of sewage per yard per day, which is very easy working, and could be more than doubled with safety. The designer of this artificial land filter, and the arrangements for aeration and revivifying the filter are worthy of commendation, but in any future works of the kind it would be wise to give more space for the settling process, and a little improvement in tank arrangements. Whoever brought forth the idea of distributing the sewage on land below the surface, did a great deal toward solving the difficulty of being able to irrigate land with sewage during hard frost, and of preventing offensive smells from such works in hot weather.

I might also state that the Penetanguishene irrigation filter is high and dry above high water mark, even at its lowest point, and can never be waterlogged or drowned and have its efficiency impaired.

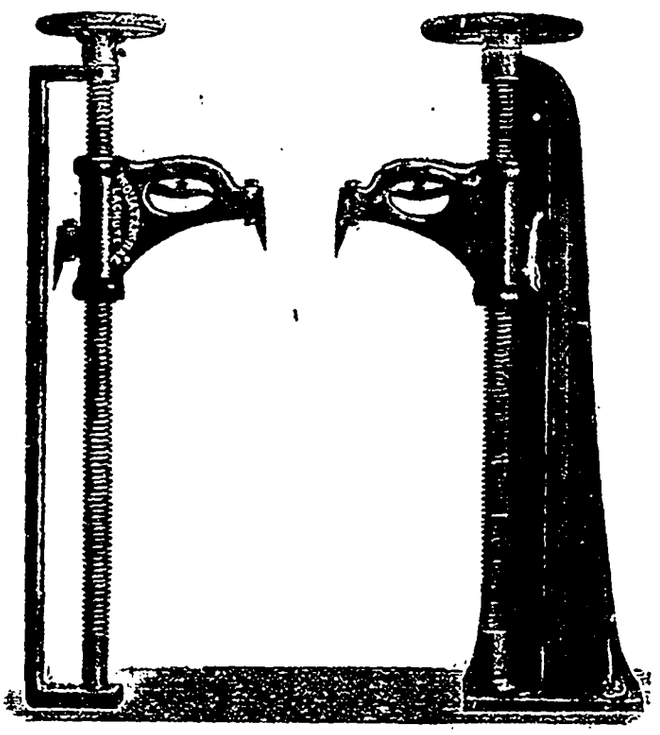
The design and arrangements are a model worth copying by those desiring a sewage system on that principle. At Penetanguishene, the elevation of the hotel being over 20 feet above the water line of the bay, made sewage disposal by irrigation easy; good fall and ventilation could be introduced, but there are few private dwellings or hotels placed in so advantageous a position as this.

The system of distributing the sewage over one foot below the face of the soil was adopted in Great Britain several years ago, for the purpose (so it was stated at the time of introduction), of being able to plough the land without impediment caused by the usual ditches and pipes used to distribute the sewage on top.

Dr. Bryce, Secretary to the Board of Health, in his printed report on the personal inspection of this sewage works at Penetanguishene, dated June 7th, 1897, states that "perhaps the most satisfactory feature of the new improvements is the sewage disposal works They are an admirable illustration of good engineering and mechanical work applied to carrying out the method of sewage filtration by surface irrigation."

## CLIMAX FROST DOG.

An illustration is given herewith of the Climax Frost Dog, designed and patented by the manufacturers, McOuat & McRae, Lachute, Que This dog weighs enough to drive into a log. By pressing a spring the head is detached from the screw, and its own weight



will send it into position in the log. Then by simply pressing a latch, it is instantly released without the use of a hammer. The advantages of these points are manifest to every sawmill man, and no other frost dog will accomplish these results.

## CANADIAN SOCIETY OF CIVIL ENGINEERS.

The first meeting of the season of the Canadian Society of Civil Engineers, was held Oct. 14th, W J. Sproule in the chair. The secretary reported a number of applications for admission and for transfer, which had been considered by the council and classified. It was also announced that the society had agreed to lease the new premises from the Bank of Montreal. The discussion on Willis Chipman's paper on the Separate System of Sewerage in Ontario, was then opened, Messrs. Van Buskirk, Ardagh, Bowman and Chipman taking part in the discussion. A paper on Fortifications, by C R. F. Coutlee, was then read, and an informal discussion on the necessity of military training in our engineering schools was held, after which it was moved by Wm. McNab and seconded by C. H. McLeod, that the thanks of the society be tendered to Mr. Coutlee for his interesting paper on Fortifications. The meeting was then adjourned.

At the meeting of the society on October 28th, J. A Waddell, consulting engineer of the Kansas City, Pittsburgh and Guelph Railway, and permanent engineer of the Omaha Bridge and Tramway Company, gave a lecture on the subject of "Bridges." This was a continuation of the lectures given last year to the students of applied science at McGill University, and all of them are chapters of a book which is to be published next January. We must not forestall the book by quoting

verbatim the really valuable matter which it will contain. In THE CANADIAN ENGINEER of November last, however, we gave a few hints of Mr. Waddell's contentions for greater beauty in construction, and a few specifications of bridges which he had already constructed. The lecture before the Civil Engineers' Society was on "Cantilever Bridges and the Designing of Piers." He objected to the general though false notion that cantilever bridges were always economical, and gave a complete list of the numerous stresses which have to be calculated upon. Instances were found in the bridges either erected or to be erected in Japan by Mr. Waddell. Some advice as to anchorages followed, and then some criticism on the largest cantilever bridges in the world, namely, the Queen's Ferry in Scotland; Lansdowne bridge over the Indus, India; railway bridge at Memphis over the Mississippi, and the Red Rock bridge over the Colorado River. The lecturer then treated of how to design the best piers for different kinds of crossing, and how to proportion them, with criticisms on the cofferdam, pneumatic and open dredging processes. These lectures are taken up largely with elaborate calculations and masses of data, which, when published, will make a most valuable reference book, and probably save days of original figuring to very many bridge designers.

## CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

The following is a corrected list of the officers of the C.A.S.E., No. 9, Berlin, Ont.: Wm. Oelschlager, past president; Geo. Steinnetz, president; Job Heyd, vice-president; W. J. Rhodes, secretary; Wm. Tiedt, treasurer; J. L. Bowman, conductor; Agt. Prizgodda, doorkeeper: S. Erglert, A. Arndt, A. Sararas, trustees. Meetings every Friday evening.

Hamilton Association, No. 7, C.A.S.E., are holding open meetings of instruction, two meetings each month, for the fall and winter, to which the public are invited through the press.

The annual dinner of Toronto branch C.A.S.E. will be held on the evening of 24th November at the Richardson House.

Toronto Association of Stationary Engineers is having open meetings on the third Wednesday of each month at its hall, 61 Victoria street, and invites all engineers and manufacturers. This month a lecture on the "Construction of Boilers," by the well-known boiler maker, J. J. Main. All are welcome.

## FIRES OF THE MONTH.

Oct. 4th.—E. C. Squire's cheese factory, Norwood, Ont. Loss on building and machinery, fully insured, $1,200.——Oct. 5th.—Smith & Elford's brick yard, Victoria, B.C., $2,500 damages.——Oct. 7th.—The Edwards Trading Co., Limited, Thurso, Que., lost heavily in the fire at South Indian, Cheney, and Racine, Ont. The total losses amount to about $30,000, a good deal of which was insured. This includes 600 cords of wood at South Indian, 400 cords at Cheney, 100 cords at Racine siding, a sawmill and planing mill and a shingle mill, 300,000 feet of lumber, 800,000 shingles. Total insurance $10,000.——Oct. 9th—Dominion Elevator Co.'s elevator, at Bagot, Man.——Oct. 13th—F. J. McManus' sawmill, Bathurst Village, N.B. Loss, about $3,000.—— Oct. 14th—Bleach and Boiler Room of the Northumberland Paper and Electric Co., Campbellford, Ont. Loss was large.——Oct. 14th—Spoolwood mill, at Sugary, N.B.——Oct. 19th—Kingsville, Ont., business block, including A. G. Adams' hardware. Loss, $4,000; H. Scratch, bicycles, $2,500.——Oct. 19th—Philp & Eckhardt's Factory, Esplanade street, Toronto. Loss, $15,000.——Oct. 20th—R. Metzler's Cheese Factory between Violet and Wilton, near Belleville, Ont. Loss, about $6,000.——Oct. 26th—Verity Plow Co., Brantford, Ont. Loss, $25,000.

"THE Electrician" Electrical Trades' Directory and Handbook for 1898 (the big blue book), corrected to January, 1898, containing a very carefully compiled list of British, colonial and foreign electricians, electrical engineers, electric light engineers and contractors, electrical apparatus makers, plant and machinery builders, instrument makers, electric bell makers and fitters, electric light, telegraph and telephone companies, electric light, telegraph and telephone engineers, wire makers and drawers, and of all persons engaged in electrical pursuits throughout the world; useful tables and data relating to electric light and traction, electric power transmission, telegraphs and telephones, electricity supply companies, home and foreign Government departments, etc., etc.; and a biographical section, giving interesting particulars of the careers of about 305 eminent men connected with electricity in all its applications, with many portraits. Full particulars will be sent immediately on application to *The Electrician* office, Salisbury Court, Fleet street, London, E.C. This valuable work will be issued January 1st, 1898.

# Mining Matters.

A STRIKE of gold-bearing rock is reported on the farm of Ira Swayze, a few miles east of Jordan, Ont.

THE Ontario Government is now completing the road into the Saw Bill district as far as Saw Bill Lake.

ROBERT WERDEN, Picton, Ont., has discovered a deposit of tourmalin in one of the northern townships of the county.

THE Harvey Hill Copper Mine, Megantic County, Quebec, has not closed down as was stated in our October number.

THE American Asbestos Company has sold its Black Lake, Que., mine, to L. & E. Wertheim, Frankfort, Germany, for $14,900.

J. C. GARVIN, Denver, Colo., proposes to use a bromide process in treating the black sand in the Saskatchewan, near Edmonton, N.W.T.

THE Toronto Technical School is putting in assay furnaces, intending to give instruction in mining processes during the coming winter.

THE mill at the Golden Cache Mine, B.C., will be run during November, and a clean up made at the end of the month to determine the value of the mine.

E. C. ROSENZI, of the Canadian-American Oil and Natural Gas Co., is preparing to make extensive borings for oil in Ontario, in the neighborhood of Belleville.

THE Rothschilds, of London, England, are reported to have made an offer of two million dollars for the Sultana and Ophir gold mining properties, near Rat Portage, Ont.

E. MCCONNEL has had men recently up above Lake Temiscamingue testing a new find of gold, and has every reason to hope, from tests made, that it will turn out to be a rich find.

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

A PLANT has just been installed by the Canadian Rand Drill Co., Montreal, at Bruce Mines, Ontario, and it is hoped that such is an indication of a revival of the mining industry in that section.

J. C. Ross, Pleasant Harbor, N.S., is doing extensive development work on a very promising property, at Tangier, N.S., which was formerly owned by the Pittsburg and Nova Scotia Gold Mining Co.

THE copper-bearing properties in the neighborhood of Kaladar, Ont., are in demand. I. M. McMaster, Rochester, N.Y., is purchasing locations. He has bargained for John A. Carscallen's mine near Flinton, Ont., for $1,500.

THE large compressed air plant, recently installed by the Canadian Rand Drill Co., Montreal, at the new pit of the old Sydney, C.B., mines, has been started and put into service. The machine is of their standard duplex type of the latest pattern.

AT Antigonish, N.S., there has recently arrived a new plant purchased from the Canadian Rand Drill Co. for the Purvis property. The compressor is of the modern duplex type. It is expected that within a few days this will be in active operation.

F. C. INNES, of the Fern mine, Nelson, B.C., stated recently that the new ten-stamp mill was working perfectly, and the percentage of saving and amount of ore treated was greater than calculated upon. The foundation for ten extra stamps is in position.

W. H. MCNEIL, managing director of the Anthracite Coal Company, stated recently that the Canmore, N.W.T., mines are now being opened and turning out 1,000 tons per month, and the capacity of anthracite mines will shortly be 3,000 tons per month.

W. A. FRASER, manager of the Government oil-boring operations at Victoria, N.W.T., has closed operations for the season. A depth of 700 feet has been reached at Victoria, with a slight flow of gas. At Pelican rapids on the Athabasca River there are good indications of oil at 820 feet.

GOLD has been found in paying quantities in the ore dumps of the silver-lead Highlander and Highland mines at Ainsworth, B.C. Maxwell Stevenson, manager of the Highlander, has received returns of $29.70 per ton in gold, from assays made at the United States assay office at Charlotte, N.C.

ONE of the most modern compressors of its size that has ever been in Nova Scotia, was forwarded by the Canadian Rand Drill Co., the other day, to H. H. Fuller & Co., of Halifax. The machine is designed for both mining and high pressures, the air cylinders being compounded and worked in conjunction with an intercooler of the latest type. The heads of the machine were of the hooded type, which renders the compressor in operation practically noiseless.

J W. TYRRELL, the engineer, Hamilton, Ont., has just returned from the interior of Northern Ontario, east of Lake Winnipeg, which is known as the Lac Seul country, where he has been examining some mining properties for an English company. Gold was found, it is said, in considerable quantities.

A TEST of the gravel taken up by the dredge employed in clearing out the ground for the middle pier of the bridge, at Edmonton, N.W.T., showed a very large prospect of platinum and a moderate showing of gold. This is said to be the first attempt at prospecting for gold in the bed of the Saskatchewan River.

THE large plant which has just been insta led by the Canadian Rand Drill Co., Montreal, at the Sultana property, is about ready to start. The mill, which contains 30 stamps, is already in place, and it is expected that the whole will be working very shortly now. Mr. Ross, the local engineer for the Rand drill people, has just returned from there.

THERE is considerable activity in mining in the neighborhood of Thessalon, Ont. A party of wealthy Americans have bonded one of the large properties and contracted with the Canadian Rand Drill Co., Montreal, to install a complete mining plant. They are going at the matter in earnest and have a large force of men on the ground. The machinery is already there and being set up.

FLORENCE, Middlesex, Ont., is now attracting a great deal of attention as an oil field. The development was only begun in September, but already a very successful well is being pumped, as we show in another column Very little can be ascertained as to the actual flow at the well, but from the machinery being purchased, and the confident air of the owners, there can be no doubt of the value of the field.

AFTER a great deal of difficulty the heavy compressor and the two immense boilers shipped some time ago by the Canadian Rand Drill Co to the Foley Mines have arrived in safety. William Brown, erecting engineer for the Rand Co., is hard at work with several gangs of men laying pipe lines and pushing forward to completion the plant, so that it may be started up within a few days now. The compressor is of the modern type, with compound cylinders, condenser, and other modern and economical appliances.

AT the Mikado Mine back of Rat Portage, all is activity, and preparations are being made for a new plant, lately contracted for with the Canadian Rand Drill Co., through their Rat Portage engineer, Mr. Ross. The plant is to consist of one of Rand latest type duplex compressors, and with a complete equipment of boilers, air receivers, drills and other accessories. The plant will be shipped within a few days now, and transportation arrangements are being made for its delivery at the mine

WORD has just been received by the Canadian Rand Drill Co., to the effect that the guarantee on the large stamp mill erected at the Crystal Mine has in every way been fulfilled, in fact the machinery throughout has been found to surpass in every way contract specifications. The contract called for a complete equipment, from the supplying of plans for the building, to the starting and operating of the mill for thirty days. Since this a hoisting plant has been ordered and is in daily operation.

WHILE great stories of the Klondyke are abroad, Nova Scotia is not behind Within the last month large gold finds have been made in various localities In Guysboro a new find, 17 feet from the surface, gave from one shot $1,000 Capt. William McKenzie, who was down to Renfrew, N S., last week, reports a great find, 8 feet from the surface, from 18 buckets of which $6,000 was taken, being the work of only three or four days. Two young men were the lucky finders.—*Colonial Standard, Pictou N.S.*

AT River Herbert, N.S., the annual meeting of the Boston Coal Mining Company (Limited) was held at the mines of the company. The following officers were elected: H. C. Whitney, president; J. Needham, secretary and treasurer; J. E. Blackemore, W. H. Baker and John C. Gordon. The increase of the capital to $1,000,000 was confirmed. The union of the Lawrence and the Victoria areas will give an opportunity to follow the veins of coal worked on the Lawrence area into the Victoria property, which has never been worked.

A RECENT despatch from Gaspe, Que., stating that the Petroleum Oil Trust Co. had shut down their operations and abandoned their works, was calculated to create the impression that the whole enterprise was a failure. It appears, however, that this is not the case. The Petroleum Oil Trust Co. is an English company, which has expended a large sum of money borrowed in England, France and Belgium, at least $750,000, it is said. What has led to the erroneous impression prevailing on the subject, is the way in which oil boring operations are carried on. The company has sunk a large number of wells on its lots in Gaspe, which represent a superficies of 100,000 square acres, but the borings were stopped the minute the presence of

E. TAILLON, Eganville, Ont., has found a silver mine on the Opeongo River.

THE latest discovery of gold in Quebec is reported on the farm of Lewis Cuthbertson, Clarendon Front, Pontiac county.

MINING is being somewhat vigorously pushed at Shawville, Que., by a Belgian and American syndicate. A good quality of zinc ore is being taken out.

IT is said that J. A Caldwell the owner of the Sultana mine, Lake of the Woods, Ont., recovered $34,800 in gold by burning the sluices, traps and flooring of the old stamp mill.

A DIAMOND drill has arrived at Dunsinane to bore in the coal mine. If the seam is thick enough to pay for working, the company will start operations soon, as the coal is of very fine quality.—*Sussex, N.B., Record.*

W H WYLIE, formerly manager of the gold mines at Marmora, Ont., is now the expert of the Great Northern Mining Company, and recently was sent to test a gold field at Lake Wawa, Ont, which assayed $692 to the ton.

THE deposits of barytes near Whycocomah, C B., are attracting considerable attention This summer we learn that Henderson & Potts, who own several good properties there, have taken out 450 tons for use in the manufacture of paints.

A NUMBER of Canadian students are entering the Michigan College of Mines, in spite of the high fees charged non-resident pupils A matriculation fee of $25 and an annual fee of $150 is now collected The session of the Michigan Legislature for 1897 changed the name of the Michigan Mining School to that of the Michigan College of Mines.

THE Dominion Coal Company has contracted to ship 2,000 tons of duff coal to the Ferrona Iron Works in Pictou county, N.S., for experimental purposes in the manufacture of coke, and particularly to ascertain whether or no the Cape Breton coals contain too much sulphur for this purpose. Dominion, Reserve and Caledonia coals will be used for these experiments.

THE River Gilbert, in Beauce County, Que., is attracting some notice lately as a gold field. In 1889, the Provincial Mining Engineer Obalski, reported that the quantity of gold in the old bed of the river was $50,000 to $100,000. Hitherto, it is said, the chief difficulty in working the property has been the matter of land titles, but this has been settled by a recent judgment

THE directors of the Crow's Nest Pass Coal Co., capital $100,000, are: Clarkson Jones, F. Wyld, Toronto; G. Gillies, Gananoque, Ont.; Wm. T. Jennings, C.E.; B. Jennings, ; Geo. Elliott Casey, Fingal, S. F. McKinnon, W. Mackenzie, J. Flett, J. G. Jones, W. R. Brock, Toronto; C. J. Miles, Hamilton; J. J. Kingsmill, Toronto; D. D. Mann, Montreal; J. Sutherland, Woodstock.

H. N. KITTSON, Hamilton, and H A Wiley, Port Arthur, about the middle of last month, brought three gold bricks from the Saw Bill mine. The bricks combined weigh 180 ounces and are valued at $3,800. They are the result of the first clean-up at the mine. During the twelve-day run of the mill about 250 tons of ore were crushed, which means that from every ton over $15 has been saved in the batteries, and on the plates. When the concentrates, which are rich, come to be treated, the ore will run at least $17 to the ton. The next clean-up took place about Nov. 1st. The company have already about 2,500 tons of ore on the dump, and between 25,000 and 30,000 tons blocked out in the workings. In other words there is already in sight, at this rate of calculation, nearly $500,000.

## Railway Matters.

THE first hundred miles of the Crow's Nest Pass Railway will be completed by December 1st.

T D. CARROLL & Co., have a contract on the Ottawa and New York Railway, at South Finch.

THE first rail on the Atlantic and Lake Superior Railway was laid at New Carlisle, Que., October 25th.

THE Drummond County Railway was formally opened from St. Hyacinthe to Chaudiere, Que., October 22nd.

SIR WM. VAN HORN recently stated that the C.P.R. would build a line from Robson to Rossland, B.C., 28 miles.

THE last rail on the railroad across Newfoundland being built by R G Reid, was laid Oct. 2nd, at Port au Basques.

CAPT. MCMILLAN, of the steamer "Princess," has accepted a position with the bridge company building the O. & N. Y. Ry. bridge.

THE Canadian Pacific Railway has placed two corps of surveyors on the road with a view to open up the Stickeen River route to the Yukon.

C. J. Pusey, president of the Irondale, Bancroft and Ottawa Railway, has made arrangements by which he will complete an additional five miles of road this fall.

The grades on the Crow's Nest Pass railway in no case will exceed one in one hundred which will make it the easiest crossing of the Rockies in existence.

Alex. McDougall, Arnprior, with a staff of twenty-five men—blacksmiths, clerks, timbermen and teamsters, has a contract on the construction of the Crow's Nest Pass Railway.

Wm MacKenzie, Toronto, and D D. Mann, Montreal, have bought the Vancouver, Victoria and Eastern Railway charter. The charter covers the line from Vancouver, through Boundary Creek and Rossland.

The Central Vermont Railway has passed under the control of the Grand Trunk Railway. It comprises about 700 miles of road, from St. Johns, Que., to White River Junction, Vermont, and the line to New London.

Wm. Gibson, Beamsville, Ont., is making rapid progress on the masonry of the reconstructed Victoria Bridge at Montreal. Very little false work has been found necessary, as the materials are run out on cars on a track on top of the covering of the old bridge.

At the semi annual meeting of the stock holders of the Grand Trunk Railroad of Canada, held Oct. 14th, in London, Sir Charles Rivers Wilson, president of the road, congratulated the stockholders on the announcement that the accounts showed a surplus of $13,540.

It is rumored that the C.P.R. is to be extended west from Reston into the Pipestone country. A Souris, Man., correspondent writes that a Government official has been directed to make a thorough inspection of the country west of [illegible]on, and make a report on it.

A new private car for the use of F. H. McGuigan, general superintendent of the Grand Trunk Railway, has been turned out of the company's shops. The car is fitted with all of the latest improvements and is handsomely finished in oak. It will be known as the St. Lawrence.

The Grand Trunk Railway system has added another official to its staff, W J. Shannon, who for some time past has been travelling over the road instructing the train hands in the proper use of the air brakes He will be known in the future as the acting air-brake inspector of the entire G.T.R. System.

Angus R. Maclennan has the contract for the grading of the first section north of Cornwall, Ont., on the Ottawa and New York Railway Green & Butler, of St. Catharines, have the second section, and P. Bonneville, of Lancaster, the third. Charles McGill, Dixons, has a section of the grading. D. R. McDonald, of Williamstown, has taken a contract for twelve miles of the grading north of Crysler.

Engineer L. L. Buck, designer and chief engineer of the new steel arch bridge to replace the suspension bridge at Niagara Falls, says the superstructure will be well under way by November 10th. The false work is almost complete, and the abutments are ready for the superstructure. As mentioned in a recent issue of The Canadian Engineer, it is the intention on the completion of the bridge to take down the old suspension bridge and erect it at Queenston, Ont., thus making a belt line possible on the electric railways.

Amongst the contracts recently taken by Paquet & Fortin, Levis, Que., according to the Quebec *Chronicle*, are a railway branch for the Laurentide Pulp Company a mile and a half in length, and west of the St. Maurice River, which is to be completed at once; a branch of the Great Northern Railway, ten miles in length, to the north of Three Rivers, and a bridge over the Shawenegan River, at five miles and a half from the Grande Mere bridge. It is to be 370 feet in length and 85 feet high. The superstructure is to be of steel, and is being made by the Dominion Bridge Company. They are also building three miles of railway and track to reach the place called Coulee Lavergne, and three miles further up than the Shawenegan River; also a steel bridge 500 feet long and 92 feet high, to be erected over a branch of the Shawenegan. Some 600 men are employed on these works.

---

—The largest elevator contract on record is that recently awarded to the Sprague Electric Elevator Co., of New York, by the new Central London Railway, which will run underground through the heart of the great English metropolis. There are to be forty-nine elevators erected in twenty-five different shafts and distributed over six miles of route. The minimum lift will be forty-one feet, and the maximum ninety-one and a half, and they will have an average capacity of one hundred passengers each. This company is represented in Canada by Jack & Robertson, St. Helen street, Montreal.

# Marine News.

The Richelieu & Ontario Navigation Company declared a 3 per cent. half-yearly dividend at a meeting, Oct. 11th.

John Whi[illegible]e, Arnprior, has launched a boat fitted with a gas engine from the works of J. R. Baird, Woodstock, Ont.

J H. Wood and S. B McNeil, Pembroke, Ont., have gone into business as boat builders at Athabasca Landing, N W.T.

Poole Bros., Yarmouth, N.S., are building a steamer 80 feet keel, 90 feet over all and about 70 tons register. She will be fitted with steeple compound surface condensing engine and steel boiler, by the Burrell-Johnson Co., Yarmouth.

Wm. Thomson & Co., St. John, N.B., have contracted for a new steamer with Russell & Co., of Port Glasgow. This boat will be delivered in January next, and will be about 2,000 tons net register, carrying 5,000 tons dead weight. The boat will be called the "Arbela."

The Bertram Engine Works Company, Limited, has contracts enough on hand to keep it employed for two years, and this press of business expedited the withdrawal of George H. Bertram, president of the company, from the firm of Bertram & Co., hardware merchants.

The Rockland, Me., Shipping Co. has sold the three schooners, "Enterprise," "Emperor," and "Fanny G.," to a syndicate composed of business men of Digby and Yarmouth, N.S. The vessels will be used in the carrying trade between Digby, Yarmouth, Boston and New York.

Louis Coste, Chief Engineer of Public Works, has written to Hon. Robert Watson, Commissioner of Public Works in Manitoba, informing him that tenders will shortly be asked for works designed to lower the waters of Lake Manitoba, a scheme for which Parliament appropriated $25,000 last session.

The side of the Soulanges Canal for a distance of 1,300 feet, and to a depth of 70 feet, fell in recently, carrying with it three large piers and doing damage which may reach $100,000. The accident happened in the night, and there is, therefore, no loss of life. The cave-in happened at what is known as the Raynor section, just above the Coteau du Lac, and at a point where the contractors were at work building a bridge.

The Grand Trunk Railway, with most commendable enterprise, has arranged for a very considerable extension of the tonnage sailing from Portland, Me., in connection with its line. There will be a monthly service between Hamburg and Portland by the Hamburg-American Co., a weekly service to London and a fortnightly service to Bristol and Glasgow. This will make an addition of 60 per cent. to the tonnage serving the G.T.R. at Portland, Me. The service will begin November 15th.

Mr. Lacouture, ex M P.P. for Richelieu, has organized two companies for the colonization of the Lake Temiscamingue region. One of the two companies has in view navigation on the lake, and will construct two boats during the winter. The other company has for its object the building of mills and the general development of trade and industry. Mr. Lacouture leaves this evening for the lake with a number of new settlers, several of whom are former Government employees whose services have been dispensed with.

St. John, N.B., papers outline great wharf improvements there to accommodate the C.P.R. The plan deals with what is known as the Long Wharf, and is to extend the present wharf 60 feet south to the harbor line, and carry it back a distance of 700 feet from the southern end, dredging a channel on each side to a depth of 30 feet, making a total of 1,400 feet wharf facing, without including the southern end, which is less than 300 feet long. The tracks to the Union depot are to be moved toward Main street to a point beyond where the wharf is to terminate. The old mill will be torn down and a grain elevator erected in the centre of the wharf. The capacity of this is to be 750,000 bushels.

A new syndicate, with a capital of $30,000, is being formed, it is said, at Montreal for the purpose of purchasing a steamer specially for pilgrimages and excursions. The new boat will have a speed of nineteen or twenty miles an hour. She will be fitted with 128 staterooms, having from two to three berths in each, and will be licensed to carry 800 passengers. The boat will ply to Ste. Anne de Beaupre from Montreal and other points, with pilgrimages and excursions only. It is also said that there will also be another syndicate formed for the purpose of acquiring two steamers to run between Montreal and Quebec to connect with the American line from Lake Ontario, and a new line which is to run on the Saguenay route between Quebec and Lake St. John.

# Electric Flashes.

THE electric railway in Sherbrooke, Que., and Lennoxville, is now completed into the centre of the latter town.

THE Canadian General Electric Company is installing an isolated direct current plant for the Raymond Mfg. Co., Guelph, Ont.

The Valleyfield Electric Company has ordered two 500 light direct current generators from the Canadian General Electric Company.

THE Canadian General Electric Company is installing a 60 kilowatt single phase alternating incandescent plant in the town of Magog, Que.

THE Hamilton and Dundas Street Railway has purchased a four motor G. E. 1,000 equipment from the Canadian General Electric Company.

DUCLOS & PAYAN, St. Hyacinthe, have ordered a 200-light, direct current incandescent plant from the Canadian General Electric Company.

THE Canadian General Electric Company is installing a 200 light direct current incandescent plant, for the North American Bent Chair Company, Owen Sound, Ont.

THE Lake of the Woods Milling Company, at Keewatin, has ordered a 25 kilowatt, steel frame, multipolar, direct current generator, from the Canadian General Electric Company.

THE Brodie mills at Hespeler, Ont., will be lighted with electricity. The Stevens Manufacturing Co., London, has a contract to install an electric plant of 140 arc lights in the factory.

THERE will be keen competition between Canadian and United States companies to supply the plant for the West India Electric Co., which is to build 25 miles of railway near Kingston, Jamaica

THE Sarnia Gas and Electric Company is installing a 60 kilowatt Canadian General Electric single phase, standard alternator, to meet the demands of its rapidly increasing incandescent lighting business.

I J. GOULD, of Uxbridge, Ont., is equipping his plant for the supply of incandescent lighting, and has made a contract with the Canadian General Electric Company for a 30 kilowatt, single phase, alternating plant.

LA CIE ELECTRIC DE ROBERVAL, Chicoutimi County, Quebec, has placed an order with the Canadian General Electric Company, for a 60 kilowatt, single phase alternating machine of the company's standard iron-clad armature, compound type.

THE Strathroy Electric Light Co., Limited, is adding an incandescent lighting equipment to its existing arc lighting plant, and has placed its order with the Canadian General Electric Company for a 30 kilowatt standard, single phase alternator of the company's latest type.

WIARTON is to have incandescent light. Young & Crawford have closed a contract with the Canadian General Electric Company for a 35 kilowatt single phase alternator. Work on the installation of the plant is proceeding rapidly and light will be turned on early this month.

THE S Morgan Smith Co., York, Pa., has recently been awarded the contract to furnish four McCormick turbines, together with iron cases, feeder pipes, valves, draft tubes, etc. These turbines will operate under 15 feet head in the celebrated electric station of the Niagara Falls Power Co., Niagara Falls, N.Y. It is claimed these are the only turbines of American design which will be used in this plant.

THE Canadian General Electric Company has an order from the Lachine Rapids Hydraulic and Land Company, for their citizens' substation, in Montreal, 2-150 kilowatt revolving field type synchronous motors, each of which is to be direct connected to 2-125 light brush arc machines. The motors will be wound to take three-phase current, at 4,000 volts direct from the primary circuit of the Lachine Company.

THE Willson Carbide Works Company of Merritton, Ont., has recently ordered two additional 150 kilowatt, revolving field, single phase alternators from the Canadian General Electric Company. These machines will be installed in the No. 3 power house, and with the four already in operation, of the same type, will be a total capacity of 900 kilowatts to be used the manufacture of carbide of calcium.

THE Light, Heat and Power Company, of Lindsay, Ont., has added to its incandescent plant a 120 kilowatt standard single phase alternator of the Canadian General Electric Company's latest type, with revolving iron-clad armature, and compounded to secure automatic regulation. The Lindsay company has already a 60 kilowatt and 30 kilowatt machine of the same type in operation for several years past, and with the new apparatus will have ample capacity to supply the incandescent lights, numbering between six and seven thousand, connected to the circuits.

THE Hull electric railway earned $31,000 more this year than last.

IT is said that Brockville, Ont., will have its electric railway next summer.

THE street railway in Kingston, Ont., has done a largely increased business this season.

LINDSAY, ONT., has had an electric fire alarm system installed during the past month.

W. H. SUMMERFELDT & SONS, have made a contract with the council to light the village of Sutton.

THE lighting plant at North Bay is to be improved by the installation of a 150 h.p. engine. A new power house will also be built.

IT is proposd to transform the Kootenay Water Supply Co.'s property at Pend D'Oreille, into an electrical plant to supply power to Rossland, B.C.

JUDGE DOHERTY, of Montreal, adjudged Norbert Lepierre the sum of $1,000, his son having been killed while in the employ of the Light and Power Company, Montreal.

A COMPANY has been organized under President Myles, of the H.G. & B., with a capital of $200,000, to extend the line from Beamsville to St. Catharines, a distance of 12 miles.

A PLAN is mooted to build an electric railway between Woodstock and Ingersoll. Stratford and St. Mary's are also spoken of as an equally good, if not better, field for such an undertaking.

THE London, Ont., Street Railway Company's roadbed and rolling stock have been assessed at $230,000, and the company's taxes will probably be increased $5,000 over last year's figures.

THE Lachine Rapids Land and Power Company has made a contract with the Imperial Electric Light Company, which is situated in the east end of Montreal, whereby the former company will be able to supply power as far east as St. Lawrence street.

IN the case of Mrs. Lang vs. the city of Victoria, which was a suit to recover damages for the death of Lang in the street railway bridge accident a year ago, the jury awarded $22,500, less $2,500 insurance, to Mrs. Lang, the widow to receive $7,500, and each child $2,500.

A number of motormen in Toronto are said to be suffering from a temporary blindness, caused by the reflection of the electric lights within the car being cast on the heavy glass of the vestibule. Some of the men are at present under medical treatment. It is proposed to overcome the difficulty by frosting the door windows.

AT a meeting of the directors of the Ancaster and Chedoke Railway, Oct. 14th, Adam Rutherford announced that he had secured all but $4,000 of the $40,000 necessary for the building of the road. He expressed his confidence of getting this by the quarterly meeting in November. A Hamilton man has promised to build the road if the $40,000 is obtained.

A. J CORRIVEAU, president of the Electric Belt Line Railway, Montreal, is said to be interested in the projected Montreal Southern Counties Railway. The route embraces St. Johns, St. Alexandre, Bedford, East Stanbridge, Dunham, Cowansville, Sweetsburg, Knowlton, Bolton, Eastman, Magog, thence over Hatley Mountain to North Hatley, Sherbrooke via Capelton and Lennoxville.

JUDGE KENNEY and several other New Yorkers visited Drummondville (Niagara Falls South), to inspect the horse-car railway which connects the three villages of Niagara Falls. The Niagara Falls *Review* says a survey has been made to Lundy's Lane and Falls View, the object being to convert it into an electrical road. The only object now in the way is the source of power, but that, it is believed, will soon be settled.

F. S. BARNARD, managing director of the British Columbia Electric Railway Co , Limited, has on behalf of his company just closed a contract with the Esquimalt Water Works Co., which will supply cheap motive power to Victoria, B.C. A power-house with Pelton water-wheels and generators will be erected at Goldstream, at which point the waterworks company will furnish sufficient water under effective working head to develop electric power. The power will be transmitted a distance of twelve miles to the sub-station of the company in Victoria and there stepped down.

THE past year has been a good one for the Montreal Street Railway Company, as the statement of net earnings for the year ended September 30th, which was issued to-day, shows the total net earnings for the twelve months are $507,885.60. Out of this a 4 per cent. dividend was paid in May last, amounting to $160,000, and another in November of 4 per cent., amounting to $166,666.67. With the latter was a bonus of $41,666.66, making a grand total of $368,333.33. This leaves a surplus of $139,552 27, which, when added to last year's surplus, gives a total of $340,245.51. During the year the company carried 32,000,000 passengers. What the percentage of operating expenses has been is not as yet given out, but it is expected to be about 55 per cent. of the car earnings. Last year the percentage was 56.48, and in 1895 it was 59.20.

BROCKVILLE, ONT., is agitating for a municipal lighting plant.

THE Canadian General Electric Company is installing a single phase alternating plant for incandescent lighting, for Jacob Morley, of New Hamburg, Ont.

THE capital of the Quebec Electric Street Railway Company is to be increased from $320,000 to $400,000, to permit of the completion of the whole line at once.

THE W. A. Johnson Electric Co., Toronto, have removed from York street to more commodious and centrally situated offices at 134 King street west, near the corner of York street.

THE Sherbrooke, Que., Gas and Water Company has added another 180 K.W. "S.K.C." machine to the plant. It has now two 180 K.W. and two 60 K.W. "S.K.C." machines, from which both light and power are furnished.

THE Teeswater, Ont., Electric Light Co., which has taken over the operation of the waterworks and electric light systems at Teeswater, has decided to install an incandescent electric lighting system, and for this purpose has placed an order with the Royal Electric Co., for one of their 500-light "S.K.C." generators with transformers, etc., the work of installation to begin at once.

JOHN PHILIP, of Grand Valley, Ont., who has heretofore been operating an arc and incandescent electric lighting plant, has decided to go into electric lighting more extensively, and for this purpose has purchased from the Royal Electric Company one of the "S.K.C." two-phase alternating current generators, with 300 light capacity, transformers and supplies. The work of construction is being proceeded with now.

THE Chatham Gas Company, Chatham, Ont., which has been operating an arc and incandescent plant in that town for the last ten years, has decided, owing to the corporation installing a plant and doing the street lighting, to go more extensively into incandescent lighting, and for this purpose has purchased a 2,000 light alternating dynamo from the Royal Electric Company, which is to be installed at once.

THE bankrupt sale of the effects of C. W. Henderson, manufacturer of electrical supplies, Bleury street, Montreal, took place on the 8th October. The electrical supplies were inventoried at $2,639, and were sold at 44 cents on the dollar; the manufactured goods at $981, and sold at 31 cents on the dollar, and the machinery at $801, went at 76 cents on the dollar. The whole lot was bought in by George Climie, acting for parties at present unknown. It is not likely that Mr. Henderson will resume on his own account.

THE Chateauguay & Northern Railway at Montreal is making preparations to handle an extensive freight business in connection with the Canadian Pacific Railway. It has ordered the equipment for an electric locomotive from the Canadian General Electric Company, consisting of a four-motor G.E. 1,000 equipment, with four-motor controllers and commutating switches. This outfit, though of less capacity, is similar to the large locomotive recently supplied by the Canadian General Electric Company, to the Hull Electric Company, which has handled as many as thirty-three cars on a shunt.

IN Rutherford v. the H. G. & B Electric Railway Co., a consent judgment was entered after the trial had commenced. The plaintiff, Adam Rutherford, claimed $5,000 damages for alleged wrongful dismissal from the position of secretary-treasurer, and $833 salary in arrears. Mr. Rutherford had been the promoter of the company, and was awarded $2,000 stock in payment of his services, and subsequently engaged as secretary-treasurer at a salary of $800 a year, to date from March 1, 1894. The defence alleged that the grant of stock covered payment for his services until a year later. After a conference between the parties a settlement was arrived at under which Mr. Rutherford received $233 and each side is to pay its own costs.

THE Lachine Rapids Hydraulic and Land Company has ordered from the Canadian General Electric Company two direct connected units for furnishing arc lighting from the citizen's station, from which it is at present supplying some 400 arc lamps, generated from steam power, with small arc machines of the "Wood" and "T-H" type. These new units will consist of synchronous motors of the three-phase, revolving field and stationary armature type, each of which will be direct connected to two 125 light "Brush" arc machines. The motors will be wound to take current at 4,000 volts direct from the primary circuit of the Lachine Company, thus saving the cost and loss in operation entailed by the use of step-down transformers. The motors will be self-starting, and are designed to operate at a very low temperature up to the rated load. The efficiency of the arc plant, operated in this way, should be very high, that of the 125-light "Brush" arc machine being not less than 86 to 88 per cent. at full load.

THE Perth Waterworks Company, Limited, which is installing the waterworks system for Perth, Ont., will use electric power for pumping. The pump house is located within the limits of the town, but the power which they intend using is about four miles away, on the Tay River. Here they are installing a water-wheel and a 200-h.p. generator which will in addition to supplying the power for pumping purposes, furnish light and power. The company has bought out the old Tay Electric Company, and will distribute light and power on the old circuits. The electrical machinery is being installed by the Royal Electric Company, which will use the "S.K.C." two-phase system for this work. The pumping is to be done by means of a 75-h.p. motor belted directly to a triplex double-acting power pump, which pumps directly into the mains, no gravity system or stand-pipe being employed. The mains are equipped with a relief valve so that the pressure can be maintained constant without varying the speed of the pump. The pump is arranged so as to be operated at two different speeds in order to raise the supply of water and the pressure for fire purposes.

THE Cataract Power Co., of Hamilton, having had sufficient stock subscribed to complete their plant, have lost no time in getting down to work. A contract has been let to A. McDonald & Co., of Hamilton, to construct the canal, which will be about 4½ miles long from near Allanburgh to the brow of the "Mountain," not far from DeCew's Falls, where a head of 270 feet will be obtained. The canal will be 30 to 40 feet wide, and 200 to 300 men will be employed in its excavation. The water will be taken from the Welland Canal a short distance above Allanburgh, and the Beaver Dam Creek will be crossed by an aqueduct The distance from the power-house to the terminus at Hamilton will be 38 miles. This will be the longest electrical transmission line as yet in actual operation, except that of the Blue Lakes Water-Power Co., of California, which transmits power 45 miles. A line is now under construction, however, from the Big Creek Water Co 's plant to San Francisco, by which electrical power will be transmitted a distance of 70 miles, so that the present work will not be phenomenal as to distance. The Cataract Power Co. will have 4,000 horse-power available, and have already closed contracts with a number of corporations and private manufacturing concerns for the supply of power in Hamilton. The principal stockholders in this company are Hamilton men, and it is expected that power will be supplied to the city by the beginning of next May. The contract for the generators, transformers, and all the electrical plant has been let to the Royal Electric Company. A description of this interesting plant will be given in a later issue.

## Personal

DONALD STEWART, C.E., died at Halifax, October 19th.

J. C. MCNABB, civil engineer, formerly of Chatham, died in Hamilton, Oct. 16th.

BENJAMIN LECKIE, of the G.T.R. shops, Stratford, Ont., has been appointed foreman in the G.T.R. roundhouse at Fort Erie.

THE father of Charles Hays, manager of the Grand Trunk, died in New York a short time ago. Mr. Hays has the sympathy of the public in his bereavement.

W. J. EARLE, C.E., who was engineer in charge of the harbor improvements at St. John, N.B., has taken charge of engineering work on the Crow's Nest Pass Railway.

IN the pulp mills at Milton, Queens county, N.S., a short time ago, Joseph S. Lone, engineer, was caught by a belt and instantly killed. His head was severed from his body.

CARL WEATHERBE, son of Mr. Justice Weatherbe, has been appointed professor of civil engineering and mathematics at King's College, Windsor, N.S., vice Professor Butler.

J YOUNG HENDERSON, of London, Eng., representing an English pulp manufacturing syndicate, has been in Canada lately, making arrangements for a supply of the higher grades of pulp wood.

SIR CASIMIR CZOWSKI, C.E., went to England last summer to have a surgical operation performed, but returned to his home in Toronto last month, without the hoped-for relief, and is now very ill.

WALTER CHAPMAN, of Barrie, has been made head of the engineering department of the Grand Trunk from Toronto to Nipissing, and all points westward as far as Detroit, with headquarters at Hamilton.

THREE new Governors were appointed at a special meeting of the Board of Governors of McGill University held recently, Sir William C. Van Horne, James Ross, and C. S. Campbell, of Abbott, Campbell & Meredith.

W. J. HAMILTON, a graduate of the Science faculty of McGill University, Montreal, has been for the past two years superintendent of the Philadelphia Smelting and Refining Works, Pueblo, Col. Mr. Hamilton has been sent to Mexico as superintendent of the works of the same company.

STEAMER "Hero," Deseronto, Ont., will have a new boiler put in during the coming winter

THE Lake Manitoba Railway and Canal Company will probably establish a steamboat service on Lake Winnipegosis.

A. J. Van Nostrand, of Speight & Van Nostrand, surveyors, has returned from his three months field work in the region of the Wabigoon.

THE D.A.R. Co.'s new steamer "Prince Edward," built for the Yarmouth-Boston service by the Earle Shipbuilding and Engineering Co., of Hull, England, is now in service.

HARRY EATON, late foreman of C.P.R. shop No. 1 (Delorimier ave.), Montre has been transferred to Farnham, Que. He left Montreal richer by many tangible expressions of friendship.

IN the Dominion Public Works Department, Paul Wetherby, a graduate of the Royal Military College, son of Judge Wetherby, Halifax, will be the chief architect and engineer, assisted by Mr. Mansel.

CHAS. D. MAZE, civil engineer, has entered an action claiming $5,000 damages from David Oppenheimer, for having made a demand of assignment against him, which demand was successfully contested.

H. C. LANDON has resigned as chief engineer of the Chicago, Peoria and St. Louis Railroad to accept a similar position with the New York and Ottawa Railroad, with headquarters at Cornwall, Ont.

CHAS. GURNEY, son of the late Chas. Gurney, founder of the Gurney Stove Manufactory, died at his residence in Hamilton, a short time ago. Deceased had been ill for a long time. Mr. Gurney was a bright business man when in good health, and was a stockholder in the Gurney-Tilden Iron Foundry.

THE friends of William Sadler, son of J. T. Sadler, and nephew of Ald. G. W. Sadler, of Sadler & Haworth, belting manufacturers, will regret to hear that he died recently at his residence, Montreal, after a continued illness. The deceased was formerly a traveller for Sadler & Haworth, and was much esteemed.

DR. BELL, M.D., B.A.Sc., of the Geological Survey of Canada has been elected a Fellow of the Royal Society of Great Britain one of the highest honors attainable by scientists. The vacancies by death in the restricted membership of the Royal Society are few, and the list of scientific men eligible for election is always large.

THIS winter, there will be sailing from St John, it is said, a weekly service to Liverpool and to London, a ten-day one to Glasgow and a fortnightly one to Aberdeen and East coast, Scotland, as well as to Belfast and Dublin, and the C.P.R. reports that the outlook for exports through St John are better this year than ever before.

JAMES MILNE, superintendent of the Toronto Electric Light Co., has resigned his position in that company to take the presidency of the Weeks-Eldred Co., of Toronto, mechanical and sanitary engineers, and manufacturers of the Jones Under-feed Mechanical Stoker. It has not yet been decided who, if anyone, will be Mr. Milne's successor in the electric light company

GEO. A. RUSSELL, engineer of the Collins Bay Rafting Company's works at the Toronto Island, has, through the instrumentality of H. P. Dwight, chairman of the investigating governors of the Royal Canadian Humane Association, been awarded a medal by that association for his bravery in rescuing from drowning a young lad named Charles Simpson, 10 years of age, on the 9th of June last.

SAMUEL R · ALLAWAY, who has been appointed president of the Lake Shore and Michigan Southern Railway, to succeed the late Daniel W Caldwell, began his business career with the late Sir Joseph Hickson, then treasurer of the Grand Trunk. He was later with Gilman Cheney in the Canadian Express Company, and went West to take a position on the Great Western with W. K. Muir. He has steadily risen, and now occupies one of the foremost railway positions in America.

ON the occasion of his approaching marriage, the officers of the Richelieu and Ontario Navigation Company met H. Foster Chaffee, district passenger agent of the company, and presented him with a handsome oak cabinet containing a hundred and twenty five pieces of cutlery, specially imported for the occasion. The presentation was made by C. F. Gildersleeve, the general manager, who explained that the testimonial was a recognition of Mr. Chaffee's merits and the esteem in which he was held by his brother officers.

THE will of the late Mr Alan Macdougall, C E, who died in England in April last, has been filed for probate. The estate amounted to $9,400, in addition to some life insurance, and the whole goes to Mrs Macdougall, to be divided between the two sons, Alan Donald Kenneth and Alan Coursolles Macdougall, and the daughter, Miss Macdougall In a note Mrs Macdougall was directed to sell the professional instruments and books, as he did not wish his sons to follow the profession of civil engineer.

WM. T. BONNER, formerly general agent for Canada for the Babcock & Wilcox Company, has recently returned from a trip abroad and will take up his residence in Montreal again, as manager for Canada for the company. Temporary quarters have been taken in the Board of Trade Building, but as soon as the decorators and furnishers can complete their work, the Babcock & Wilcox offices will be located in the Mechanics' Institute Building. A full line of samples and models of the Babcock & Wilcox Company's water tube boilers and accessories will be exhibited. Mr. Bonner has many friends in Canada who will be glad to welcome him back.

## Industrial Notes.

LONEY & MCDONALD have erected a new creamery at Williamstown, Ont.

THE Northern Elevator Co., of Winnipeg, is putting up an elevator at McLean station

M. SHERIDAN is about to build a sawmill at Aylmer, Que., which is to cost $50,000.

THE towns of Berlin and Waterloo, Ont., will, it is said, build an isolation hospital for their joint use.

IT has been announced that the Lake of the Woods Milling Company will erect an elevator at Qu'Appelle.

BROWN BROS, Welland, Ont., contemplate fitting up a steam plant as auxiliary power to run their flouring mill.

A LARGE and modern cheese and butter factory is in course of erection on the G.T.R. line at Bainsville, Ont.

JAS. SAUNDERS, flour miller, Whitewood, Assa., proposes building an elevator at his mill of 25,000 bushels capacity.

FOUR of the shoe manufacturing firms recently burned out in Quebec intend to resume business before January 1.

WM. BAKER, Arnprior, Ont., has recently supplied 30 car loads of brick to the O.A. & P.S. Ry. at Depot Harbor, Ont.

THE D. Moore Company, Hamilton, Ont., advanced the wages of the moulders in their foundry five per cent., Oct. 16th.

CHAS. FAWCETT, proprietor of the Sackville, N.B., stove foundry, is completing a large stove warehouse. It is 325 ft. long, 95 wide, and with two flats.

THE Downer Pattern Works, Wellington street west, Toronto, was scorched by fire last month, but Mr. Downer announces that his establishment is again in working order, and he is prepared to fill promptly all orders that come in.

JAMES REID, Quebec, has sold the Pont Rouge Pulp Mill to President McDougall, of the Montreal Quarry Company, who is said to represent a syndicate of Montrealers who intend to spend $40,000 to $50,000 on development.

THE Cowichan Lumber Company, Limited, is to be incorporated to do business at Bobcaygeon, Ont. Capital, $150,000. The incorporators are: M. M. Boyd, W. T. C. Boyd, Bobcaygeon; G. Boyd, H. J. Wickham, Toronto; J. D. Flavelle, J. G. Edwards, Lindsay.

THE Minnesota and Winnipeg Lumber Company, a new organization, will build sawmills in Winnipeg shortly. They have purchased timber limits south of Lake of the Woods, and will construct a canal some fourteen miles to connect with the watercourses leading to Winnipeg.

THE Vessot grain grinder, exhibited at the Toronto Exhibition by the manufacturers, S. Vessot & Co., Joliette, Que., attracted much favorable comment, and a large number of orders have been placed in Ontario for this machine, which was awarded the gold medal at the World's Fair, Chicago.

THE Canada Heating and Ventilating Company, Limited, is applying for a Dominion charter to manufacture stoves, ranges, furnaces, etc., in Toronto. The proposed capital is $25,000, the incorporators are: J. McKelvey, S. Birch, Kingston, Ont.; J. T. Johnston, A. F. Webster, and C. W. Kerr, Toronto, Ont.

ATTENTION is called to the announcement in another column of the sale of the Londonderry Iron Co.'s property at Londonderry, N.S Besides 30,000 acres of mineral land, the company have two blast furnaces, two arc kilns, 67 coke ovens, a rolling mill, a pipe foundry and general foundry, machine shop, etc. Further particulars may be had from Macdougall Bros., Montreal.

THE seventh annual meeting of the Association of Architects of the Province of Quebec was held in Quebec recently, and was presided over by A. T. Taylor. There were present J. F. Peachy, A. Raza, A. C. Hutchison, Jos. Venne, S. H. Capper, A. B. Dussault, A. Mailloux, J. Nelson, J. A. Monette, J. P. Ouellet, J. Z. Resther, G. A. Tanguay, M. Perrault, C. Dufort, H. Stavely, D. Oulette and A. H. Larochelle. After the reading of the minutes of the last two sessions and of the annual report by Jos. Venne, the secretary, the election of officers for the ensuing year took place, with the following results: President, J. F. Peachy, vice-presidents, A. Raza, A. F. Dunlop; treasurer, A. Maxwell; secretary, Jos. Venne, council, A. T. Taylor, C. Baillarge, A. C. Hutchison, J. Nelson, O. Mailloux, L. R. Montbriand.

PIPPY & WRIGHT, Revelstoke, B.C., are starting a sash and door factory.

THOS. STEPHENSON, Cannington, Ont., is extending his carriage works.

THE Locked Wire Fence Co., London, Ont., is exporting to Wellington, New Zealand.

THOROLD, ONT., is trying to induce the rubber factory at Port Dalhousie to remove to that town.

ST. JOHN, N.B., will, it is said, float a loan of $125,000, to be applied to the harbor improvements.

THE waterworks plant at Waterloo, Que., has been offered to the municipality by the owners for $21,000.

A BOX factory is to be established at Orillia, Ont., and the corporation will exempt it from taxation for a period of ten years.

MAYOR BREITHAUPT, of Berlin, Ont., is reported to have said that he would not be satisfied till the town bought a steam road roller.

IT is said that the Rathbun Co. will remove its saw mill from Lindsay to Fenelon Falls, Ont., thus saving a considerable sum in towage.

CORNWALL, ONT., which recently returned to Brockville, Ont., the road roller hired from that town, will probably buy one for its own use at an early date.

ONE of the conditions upon which the contract of building the sewers in Nelson was let to E. Bragg, was that he should pay $2.50 per day to his laborers.

THE village of Ashburnham, Ont., is placing a water system chiefly for fire protection, the supply to be taken from the Peterboro waterworks by meter.

THE town council of Welland, Ont., has decided to buy from Goldie & McCulloch, Galt, Ont., two boilers of 40 h.p. each and one 80 h.p. engine for $1,275.

W. H. LEVER, the manufacturer of "Sunlight" soap, will, it is said, establish a large factory in Canada, at Toronto, and another somewhere in the United States.

THE Hon. A. S. White, W. J. Mills and E. A. Charters are a committee to prepare a report on the cost of a sewage system and water supply for Sussex, N.B.

COTE ST. PAUL, near Montreal, is to have both a drainage and light system. It is the intention to complete the drainage first, and work will be proceeded with at once.

THE New Denver, B.C., electric light plant is likely to be so extended as to supp · power for pumping the proposed water supply. The town is asked for a bonus of $2,000.

ABRAHAM GOODWIN and John Kerr, Brantford, have bought out the repair department of the A. R. Williams Co.'s machinery agency there, and will operate it on their own account.

LOCAL newspapers in Newfoundland are pleased at the increased prospects of the development of the pulp industry in that colony Scottish dealers are now said to be entering the market freely.

JNO. MCDOUGALL, Montreal; has the contract for putting in two filters, each of 216,600 gallons capacity per 24 hours, in connection with the Renfrew waterworks plant now being installed. Price, $3,000.

BUDD BROS., Renfrew, Ont, are lighting their premises with acetylene. They have built the isolated stone or brick receptacle outside the building, required by the new regulations of the fire underwriters.

THE Canadian Typograph Co., Windsor, Ont., elected the following officers at the annual meeting: Joseph Taylor, president; F. S. Evans, secretary-treasurer. Cameron Curry and George H. Scripps, directors.

THE Milner-Walker Wagon Company is converting the old sugar refinery in Walkerville, Ont., into a wagon factory. When the change is complete the works in Chatham will be closed and the whole business moved to Walkerville.

THE Hamilton and Toronto Sewer Pipe Co., Hamilton, Ont., has had its assessment fixed by the city council at $8,000 for five years. This amounts to a considerable exemption on the fine new premises the company is building.

THE Sherbrooke Street Railway Co. is using one of the Geo. E. Smith power rail bending machines in the construction of the line. This is a great labor saving machine; being very powerful, it does the work of ten men and has a capacity of one rail per minute.

PORT COLBORNE, Ont., recently sent a committee to Caledonia, N.Y. (a town of 1,200 inhabitants), to report on the waterworks plant there. It was found that the pumping engines were run by natural gas engines, electrically ignited, and the cost of fuel during August was $3.57.

A FARMER'S elevator company is being established at Lumsden, Assa. It is proposed to build a 30,000 bushel elevator.

THE Chicago firm which is manufacturing the three-wheeled "bicycle" is looking for a site for its Canadian factory.

DEYBELL & CO., of Souris, have two new elevators under construction, one at Killarney, and the other at Pipestone, Man.

WM. POSTLETHWAITE is making arrangements to build an elevator at Souris, Man., for the syndicate of grain dealers of which he is a member.

THE people of Renfrew have subscribed over $700 to assist W. N. Roberts in rebuilding his wood working factory, burned a short time ago.

PUGSLEY, DINGMAN & Co., Toronto soap manufacturers, are moving to Toronto Junction, exemption from taxes for ten years having been granted.

THE new elevator for the Montreal Transportation Co. at Kingston, Ont., will have two legs and a discharging capacity of 24,000 bushels per hour.

NELSON, BUZZELL & Co., Cowansville, Que., report a very busy season in creamery and cheese factory apparatus, of whose manufacture they make a specialty.

THE S. Morgan Smith Co. has recently shipped to H. Mc. Hart for his pulp mill near Halifax, N.S., a 36 inch horizontal McCormick turbine on horizontal shaft, which will develop 350 h p.

H. W. PETRIE, of Toronto, has sold to George Easterbrook for shipment to Delagoa Bay, South Africa, an engine, with other machinery and supplies, for his flour mills to be erected there.

AT the farm of Mr. Hardiman, three miles from Sault Ste. Marie, a young man, David McGill, was killed and four others seriously injured, by the boiler of a steam thrasher exploding on October 16th

THE work on the new water supply system in St. Hyacinthe, Que., is being pushed to a successful conclusion. The original grant of $35,000 has been found inadequate, and has been increased to $50,000.

THE estate of Alex. Rankine, proprietor of the nut and bolt works, St. John, N.B., who made an assignment early in the year, has been wound up. The creditors were recently paid a dividend of twelve cents on the dollar.

THE city engineer of Toronto has been instructed to report on the purification and disposal of sewage from the Garrison Creek, Rosedale and Don sewers. This is the first step toward the removal of sewage pollution from the bay.

THE tannery owned by A. G. McCrady & Son, Brockville, Ont., which has not been worked for some time, has been started up again, a lot of new machinery supplied by the Lancaster Machine Works of Lancaster, Ont., having been installed therein.

THE cement in use in the new Queen street subway, Toronto, is being supplied by the Owen Sound Portland Cement Co., Limited, Shallow Lake, Ont. This company is preparing to enlarge its output considerably, and is now building four new kilns.

THE description of separate sewage systems for the disposal of surface water and domestic sewage in another part of this paper, is of interest in connection with the report of Willis Chipman on this subject, recently made to the city council of London, Ont.

CHAS. CASSILS has been appointed agent in Montreal for the Carnegie Steel Company, Pittsburg, Pa, producers of rails, angle bars, and other heavy iron work. The trade between the United States and Canada in this class of merchandise is rapidly growing.

THE Wm. Emerson Manufacturing Co., Lawrence, Mass., has concluded arrangements at Granby, Que. The W. Hibbard water power has been secured, and a building 50 by 100 feet, two stories high, is to be erected. The municipality granted exemption from taxation.

EXTENSIVE alterations have been made in and about the G.T.R. depot at Cornwall, Ont. The end of the freight shed has been pierced and a track laid through the same, connecting with the electric street railway, to enable that company to handle the freights for the town and mills.

WM. Harris, Toronto, cattle dealer, has built an abattoir for export business in chilled meats, just to the south of the Toronto cattle market. The building is now nearly ready for occupation, and will, it is understood, be supplied with cold storage apparatus by the Linde British Refrigerator Company.

THE DeLoach Mill Mfg. Co., of Atlanta, Ga., manufacturers of sawmill machinery, hay presses, cane and grinding mills, and the James Ohlew & Sons Saw Mfg. Co., of Columbus, Ohio, have placed the Canadian agency for their products in the hands of the Lancaster Machine Works, Lancaster, Ont.

SOME lumbermen are figuring on building a canal from Buffalo Bay, on the Lake of the Woods, to Seine River. There is a fall of three hundred feet and over between these points, and the scheme embraces the floating of logs to Winnipeg to be sawn into lumber from the Lake of the Woods timber limits, the supplying of water from the lower end of the lake to the city, and a water power system.

THE gas engine works of J R. Baird, Woodstock, Ont., are now running overtime. One of Mr. Baird's gasoline engines has been purchased for use at the Royal Military College, Kingston, and one has been bought by the proprietor of the Mitchell *Advocate* to run the presses of that paper. Another Baird engine has been shipped to a Toronto man to operate an isolated electric lighting plant.

GEORGE H BERTRAM, president of the Bertram Engine works Company, Limited, Toronto, the great steamship and engine builders, and also of the hardware firm of Bertram & Co., has been compelled, owing to the increase of the shipbuilding company's business, to withdraw from the management of the hardware firm His successor is his son, John H Bertram, and the style of the firm becomes Bertram, Wilson & Co.

THE S Morgan Smith Co., of York, Pa., has recently shipped to the Acadia Pulp Co., Milton, N.S., a pair of 36-inch McCormick turbines, mounted on horizontal shaft, which, when placed in position, will develop 1,500 h p. The single 33 inch McCormick turbine, mounted on horizontal shaft, shipped a couple of weeks ago to this same company for the pulp mill in New Germany, is now in operation and has 300 h.p. capacity.

THE Tombyll Upholstering and Frame Manufacturing Company Limited, is asking for incorporation, the chief place of business is in the town of St. Henri, Que. The proposed amount of capital is $75,000 The incorporators are Rasmus Nielson Tombyll, manufacturer, St Henri, Wm. Henry Turner, Montreal, George H. Labbe, Montreal, manufacturer, Thos Tombyll, St. Henri, upholsterer, Amedee Anaclet Bernard, of St. Henri, physician.

THE evidence in the Sherbrooke Water Works arbitration case has all been submitted, and the commissioners, Wm. Kennedy, C.E., Montreal; B D. McConnell, Westmount, Que., and E. H. Keating, C E, Toronto, have made their report. The witnesses on the side of the city were Willis Chipman, C.E., Toronto; Charles Baillairge, C.E, Quebec, and J A U Beaudry, C.E., Montreal; and those for the company were A Sangster, C E, superintendent of the works; E. F. Waterhouse, sec-treas; S W. Jenckes, of the Jenckes Machine Co.; R. N. Arkley, millwright, and others. The property included the water power and pumping station land, the reservoir lots, the plant and piping, and the unexpired portion of the contract. The award is for $115,967, of which $21,897.69 is the value of the unexpired contract Cost of the arbitration, including witness fees, was $2,000

THE main power for the Perth, Ont., waterworks is to be brought from a dam four miles up the Tay. John McDougall, Montreal, has been engaged to build the dam and the flume, and to put in the water-wheel and build the power-house. The Royal Electric Company, of Montreal, will put in the electrical plant. From this plant the waterworks company will rent power in town where wanted. The company has arranged to use an island for the reservoir, etc They will run an open drain from the upper end, 15 feet wide at the top, 10 at the bottom, with a depth of water of 4 feet At the end there will be a filter-bed The water thus purified will run into a collecting basin at the end of the filter and enter a fifteen inch pipe, where it will find its way 1,200 feet under and beside the river channel till it reaches the suction well. The pumping-house, which will be built behind this, will be of brick on stone foundation, 30 x 30 feet. A fifteen-inch main will supply the water from this to the town.

THE Recorder of Montreal rendered judgment recently in the case of the City vs. Eusebe Paquette, contractor, for using hollow tile instead of ordinary bricks in the construction of the inner walls of a building. The action was dismissed with costs against the city, the court holding that in the case at issue the wall complained of had been shown to be perfectly safe for the weight it had to bear, while the evidence went to establish that, in case of fire, the tile walls were superior to others, on account of their ability to withstand more heat. The by-law under which the action was taken was one to prevent accidents through defective construction and through fire, the hollow tiles, which were invented only after the passing of this by-law, were proved to be of incombustible material, and to answer both purposes fully. As for the pressure that they could stand, the tests made at McGill College were conclusive, and the court had no hesitation in saying that in the present case, at least, the requirements of the law had been fully met.

A VERY large number of the employees of the Central Bridge and Engineering Co., Limited, waited upon W. H. Law, the late managing director, at his residence, a short time ago, and presented him with the following address: "*To Wm. H. Law, Esq., C.E.*:—The employees of the Central Bridge and Engineering Company, Limited, upon the severance of your connection with the works desire to avail themselves of this opportunity of expressing to you their keen appreciation of the kindness received from you in the past. Those of us who have been connected with your works since their inception in the town of Peterboro', over fifteen years ago, fully realize the amount of ability and perseverance required to place these works in a position to successfully compete with the long established bridge firms of Canada, and in their own particular line to occupy a place second to none, as shown by the important works recently completed by the company. We join in wishing you and Mrs. Law all possible success and prosperity in the future, and beg that you will accept these slight memorials of our esteem and regard. Signed on behalf of the employees, Geo. Baker, J. Daynard, John Glenn, R. Robson, C. Dawson, A. Craig, Wm. Foster, jr., F. Hamilton, C. Stevens, Thos. Jevons, W. J. Francis. Peterboro', Ont., Aug. 25th, 1897." The mementoes mentioned consisted of a gold watch chain and locket, with monogram, combining the letters, W. H. L., and on the obverse a suitable inscription. The gift to Mrs. Law is a gold ring set with a solitaire diamond. Mr. Law is at present engaged in connection with several patents he holds for England, Canada and the United States.

A CORRESPONDENT of an English industrial paper states the case of the employers as against the strikers in the present war in the engineering trade in Great Britain, thus "The real issue in the present severe struggle in the engineering works of this country has been obscured by irrelevant matter The cause of the struggle is that the trade unions have interfered in the management of the works by their owners, and have ordered the owners to make serious changes in their management under threat of compelling the workmen to strike. The trade unions have ordered the owners to employ full-priced mechanics to work certain machine-tools that can be worked by junior hands or laborers, and are so worked in other countries. The trade unions have ordered the owners to work each machine-tool by a separate man, instead of one man working two or three machine-tools simultaneously, as is done in other countries. They have ordered that a uniform rate of wages be paid in each trade, for good, bad, or indifferent hands. They have ordered certain men to be discharged from the works because not members of the trade union. They have ordered certain foremen to be discharged, because not under the control of the trade union. They have ordered the speed of turning out work from certain machines to be limited below their full capacity, for the purpose of increasing the number of workmen necessary. They have ordered that one mechanic shall not do any work of another trade, although competent to do it and required to do so for the convenience and expedition of completing the special work in hand. And now the trade unions are wanting to order the owners to pay the workmen nine hours' wages for eight hours' work, and to let their machinery stand idle for the remaining hour of each day."