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
- [x] Bound with other material/
  Relié avec d'autres documents
- [x] 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.

- [ ] Coloured pages/
  Pages de couleur
- [ ] Pages damaged/
  Pages endommagées
- [ ] Pages restored and/or laminated/
  Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed/
  Pages décolorées, tachetées ou piquées
- [ ] Pages detached/
  Pages détachées
- [x] Showthrough/
  Transparence
- [ ] Quality of print varies/
  Qualité inégale de l'impression
- [x] 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. II.—No. 12. TORONTO, APRIL, 1895. PRICE, 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, ELECTRICAL, LOCOMOTIVE, STATIONARY, MARINE 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, 6s. Advertising rates on application.

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

BIGGAR, SAMUEL & CO., Publishers
E. B. BIGGAR
R. R. SAMUEL
Address—Fraser Building, MONTREAL, QUE.

Toronto Telephone, 1392. Montreal Telephone, 2589.

ALL MANUSCRIPTS, EDITORIAL CORRESPONDENCE, NEWS ITEMS, ETC., SHOULD BE ADDRESSED TO THE MONTREAL OFFICE.

CONTENTS OF THIS NUMBER:

THE SECOND VOLUME COMPLETE.

This number closes the second year of THE CANADIAN ENGINEER, and an index of Vol. II. accompanies this paper for the convenience of those who wish to bind it for reference. Any reader wishing to have the volume bound at our offices can do so, on remitting $1 in addition to the subscription, and sending us the back numbers express paid. The bound volume will be returned express or post paid in a few days after receipt at either our Montreal or Toronto office. The price of the bound volume to non-subscribers is $2.

Every reader who desires to extend the influence of the paper, and who knows a friend who would like to subscribe, will confer a favor by getting their order to begin with the new volume in May.

For THE CANADIAN ENGINEER.

DOWN IN A BELGIAN COAL MINE.

BY B. LIPPENS, MONTREAL.

(Concluded from last issue.)

Let us now speak of the dangers to which the collier is exposed. It is only just to say that everything threatens him. The four elements, earth, water, air, and fire, are all his enemies, and can destroy at any moment his feeble existence. Notwithstanding all the precautions possible, in spite of stone walls, and beams, and scaffolds, which support the ceiling, the immense volume of earth and rock above his head may fall *down and bury him alive at any moment. Is this not* terrible? Yet accidents of this kind may occur in any sort of mine. It happens sometimes also that sudden inundations destroy the mines. The water accumulated in old excavations or underground holes finds suddenly an inlet, rushes in with violence, carries everything before it, men, horses and wagons, and smashes the doors and woodwork. After this scourge has passed, anyone looking on would see an underground river, the black waters of which are covered with dead bodies and fragments, and everything enveloped in a silence more profound than the grave.

But the greatest terror of the collier is *fire-damp*. This requires an explanation. Certain species of coal evaporate constantly, though in small quantities, a kind of gas called carburetted hydrogen. This gas, when pure, burns like ordinary gas, but when mixed with air, it forms an explosive mixture. One part of this gas mixed with six parts of air produces a most violent explosion.

A small spark of fire is sufficient to produce terrible accidents. It is expressly forbidden miners to have in their pockets pipes, matches, or anything that can produce fire; they cannot even open their own lamps, for they are so thoughtless and so accustomed to danger that they throw themselves into it without necessity and cause their own ruin by their imprudence. Most accidents are caused by the rashness of the miners themselves. It must be remarked here that with a safety lamp, it is possible to go into a gallery where the explosive agent is accumulated, though it would not do to work there. This lamp was invented by Sir Humphrey Davy, who discovered that a flame surrounded by a metallic tissue caused only very small explosions within the lamp. The safety lamp has been much improved since its invention, and has rendered a great service to humanity. When an explosion occurs a terrible detonation is heard at a great distance. In the centre of the explosion everything is crushed, smashed, upset. Carriages, tools, timber, rocks, coal, and dead bodies are all seen in a confused and inextricable mass. At the same time *carbonic acid*, called by the miners choke damp, is formed when the mine fires, and *fills the galleries, killing those who are near the* scene of the disaster. The shaft is often damaged and blocked up, and sometimes all sorts of debris are vomited from the shaft, which seems turned into the crater of a volcano. When there is more than one-third of pure coal gas gathered in the galleries, there is no explosion, but the gas takes fire. As that gas is much lighter than air, it fills the upper part of the galleries, and when it catches fire, the only way to escape is to run on hands and feet as quickly as possible. There may be three or four minutes time available for escape in that way, but the heat soon becomes so intense that the unfortunate colliers cannot be saved. When the galleries are not very low, interesting scenes sometimes take place. Then is the time for courage and self-devotion. Some are brave enough to run under the fire covered with an impenetrable cloak, and having on their heads a sort of absorbent hood, dipped in water; so they rush in, either *to drag out those that are helpless*, or to get the fire-extinguishers to work. These are cylinders which throw out a gas that serves to put out the fire. Sometimes they succeed in *choking* the fire by shutting the doors

and depriving it of air. The most extensive catastrophe caused by a fire of this kind took place in 1869, at Avondale, Pa, in which 300 miners lost their lives. Some miners of the neighboring districts sacrificed their lives while endeavoring to rescue their comrades, not a single one of those that were below escaping. Sometimesit is necessary to shut the shaft in order to smother the fire, and if that succeeds, the air pump has to work several days afterwards in order to drain out the foul air. In a very few instances it has been necessary to flood the mine with the water of the river. That was done on one occasion near St. Etienne (France), and it took three months to put the fire out. In a similar instance, it took a year and a half to master the fire in a mine of Pennsylvania. If there be no water at hand, and subterranean holes bring air into the mine, it may burn for years. I was told that there is a mine in Scotland which has been burning for forty years. Near St. Etienne, at a place called *Brûlé*, a mine has been on fire for two centuries past. The same occurred in Wales, in which case the fire underground heated the surface of the ground so thoroughly that the soil, which was marshy and light, became exceedingly fertile, yielded two crops a year, and allowed the cultivation of plants of the tropics. But the fire went out after three years, and that strange hot house in the open air disappeared.

Some details on the life and habits of colliers may not be without interest here. In Belgium there are about 100,000 people working in the coal mines. In England the population of the mining districts is more than half a million; it is somewhat less in France, and much less in the United States. They are generally, at least in Belgium, simple minded, rude, ignorant people, more especially the older ones; for in these latter years the rising generation is a good deal better educated and instructed. Still it is very amusing to hear some of the older men explain their peculiar geological theories. The earth, they will say, is a living being; water is the blood and coal is the marrow of the earth; explosions or inundations are the ways by which it takes revenge on those that cut and wound it. A new seam should not be commenced on a Friday, for it would become lime-stone. If a miner, on his road, meets a black cat, or sets his foot on two bits of straw forming a cross, he will go home and not descend that day, in order to avoid an explosion. Mines have also their special spirits, and some of them are very wicked—at least that is what the miners say. They break the shafts and galleries, steal the coal or change it into blackstone, run away with the lanterns, and play all sorts of bad tricks like truant school-boys. Some miners will pretend to have seen them, and describe them as four, or even ten-footed beings; others allow them no feet at all, and so it would be very hard to class them in natural history.

But these men, though often frightened at nothing, have a superhuman courage when there is real danger. To save a comrade from a perilous position, they will often stake their own lives, and even fight over the honor of going first to meet the danger. Thousands of volumes could be filled with the stories of courage and self-sacrifice which have been witnessed in these dark regions.

For THE CANADIAN ENGINEER.

THE SWELLING AND SHRINKAGE OF EXCAVATED MATERIAL.

BY CHARLES BAILLAIRGE, CITY ENGINEER, QUEBEC.

The Harbor Works, Quebec, as we all know, have been fruitful of suits and counter-suits bearing on the question of allowances to contractors by engineers in charge, for what may be termed the swelling or expansion (in French, *foisemament*) of excavated material, as compared to the space it occupies *in situ*.

These allowances were never contemplated at the time the works were commenced. The timekeepers or overseers (some of them) had admitted in *enquête* having been paid by the contractors as well as by the Government, without stating what for. Nevertheless, had the contractors been satisfied with the quantities of dredging they had been paid for at the respective prices of 25 to 35 cents per cubic yard, according to depth, it is not likely the query would ever have arisen; but they were not or pretended not to be satisfied either with the total quantities or with the proportional ones, claiming that there was more of the deeper dredging at 35 cents, as against that at a less depth and price.

It is this that caused the Government to appoint an engineer, Mr. Steckel, to overhaul the quantities and ascertain whether in reality the pretensions of the contractors were in any way or to any extent well founded; the curiosity of the Government and suspicions being also aroused by the fact that the payment of the inspectors by the contractors must have been in some way for value received.

Mr. Steckel's inquiries led to the fact that not only were the contractors absolutely without a leg to stand on in their claim for additional dredging, but that they had actually been paid for quantities by 33 per cent. in excess of the actual or *situ* measurement; and it was to cover this over-quantity and eliminate, if possible, any suspicion on the part of the Government that the idea was hit upon of explaining it as due to an allowance or percentage which, it was pretended, was made and should be made to cover the swelling or expansion of the material.

To render this plain, it must be remembered that the contract stipulated scow measurement, and it had to be shown that the additional quantity given by scow measurement, as compared with the *situ* estimate, was explainable by said pretended swelling or increase in bulk of the excavated material.

Now, had the tests made by Mr. Steckel borne out the pretended swelling or expansion, the contractors' pretensions would have held good, that they were only actually paid for net scow quantities; but Mr. Steckel's experiment on some 1,500 yards of material which he caused to be dredged for the purpose from the interior of the wet dock, and therefore absolutely similar in nature to the material taken out by the contractors, instead of showing an expansion of 33 per cent., only gave barely 3 per cent., which being indicative of the fact that some unhallowed practices had been resorted to, either in the way of putting in more scow loads than had actually obtained, or by entering as scow loads fractional portions thereof, or scows unfilled or only partly filled, the Government sued the contractors for reimbursal of money overpaid in that manner. And that something must have been wrong or crooked somewhere must be admitted, from the fact that when the contractors saw from the evidence adduced that the case appeared as if it would go against them, they com-

promised the matter with the Government by offering to reimburse a certain sum on the overpaid dredging. From the very contradictory evidence given in the case, varying from nought to 40 per cent., it would appear that this expansion of excavated or broken and disintegrated material is a very much unknown quantity, and in fact very little that is reliable is known on the subject. In reality, such expansion varies from $\frac{7}{8}$, or 87½ per cent., in the case of a solid cubic yard of stone broken into road metal, not only down to nothing, but in certain cases or with certain soils passes to the other side of zero, and becomes minus or a shrinkage or diminution of the material excavated or loosened into its elementary parts.

Very few authors allude to the subject in any way, and few or no experiments have been made to ascertain and tabulate the ratios and their time-varying values.

Trautiome has it, under the heading not of expansion, but of "Shrinkage of Embankment;" that "Although earth when first dug and loosely thrown out, *swells* about one-fifth part, so that a cubic yard in place averages about one and one-fifth, or 1.2 cubic yards when dug; or one cubic yard dug is equal to five-sixths, or to .8333 of a cubic yard in place, yet, when made into embankment, it gradually subsides, settles or shrinks into a less bulk than it occupied *before being dug.*"

He gives the following approximate averages of the shrinkage; or, in other words, the earth measured in place in a cut, will, when made into embankment, occupy a bulk less than before by about the following proportions:

Gravel or sand about	8	per cent., or 1 in	12½ less
Clay or sand about	10	" or 1 in	10 less
Loam "	12	" or 1 in	8⅓ less
Loose vegetable surface soil,	15	" or 1 in	6⅔ less
Puddled clay	25	" or 1 in	4 less.

He adds that from some trials of his own, 1 cubic yard of any hard rock in place will make from 1¾ to 1¾ cubic yards of embankment, say an average of 1.7 cubic yards; or that one cubic yard of rock embankment requires .5882 of a cubic yard in place. He found that a solid cubic yard, when broken into fragments, made about (1) 1.9 cubic yards of loose heap; (2) 1¾ yards carelessly piled, (3) and 1.6 yards carefully piled; or (4) 1½ cubic yard of very carelessly scabbled rubble; or (5) 1¼ yards of somewhat carefully scabbled; or, in other words, that

No 1 gives of solid	parts	.526,	and of voids	474=1000
No 2	"	"	570	"	"	430=1000
No 3	"	"	630	"	"	.370=1000
No. 4	"	"	.670	"	"	.330=1000
No 5	"	"	800	"	"	.200=1000

It need hardly be said that in dealing with such comparatively non-absorbing material as solid stone, these ratios can easily be obtained by weight or by the quantity of water displaced.

These figures of Trautiome I am in a position to substantiate only as regards a solid yard of stone reduced to road metal, the solid yard weighing two tons, or 4,480 pounds; while the same bulk of metal gives only 2,440 pounds, or little over one ton, as ascertained by actually weighing a cubic yard of the metal as a basis from which to determine the number of cubic yards supplied and to be paid for on our Quebec contracts, of about 30,000 cubic yards, for the last two years.

Now, while common earth or dirt, when freshly excavated, may swell some 20 per cent., or one fifth, as Trautiome says, such is not the case with sand of the description dredged on the site of the Quebec Harbor works; nor has the writer upon trial found it to expand or occupy in the loose a bulk greater by more than 5 per cent. than in the solid or *in situ*, and from experiments purposely made from successive heights by the writer, and on which to base his testimony as given in the Exchequer Court in suit alluded to, he found that the wet sand, as excavated and handed up by the dipper and then dumped into the scow, did fall just with such a thud or force or weight of impact as to consolidate it or cause it to enter into exactly the same space as it occupied *in situ* in the bed of the river, and that consequently the contractors could claim no allowance for expansion on material of the kind.

Many apparently plausible arguments were adduced to shake the faith of the court in the premises; that is, in the result arrived at by the experimental work of Mr. Steckel on some 1,500 yards of the material, as already stated, such as the fact of the out or overflowing water from the surface carrying with it a heavy percentage of the stuff; and so it would, had it been mud or sludge instead of sand; as if the court were blind enough not to see that even if the assertion were true it would be no argument anent the correctness of the result arrived at, since the stuff, if any, falling overboard, would flow or fall back into the excavation being made, and be scooped or dipped up again, and again find its way into the scow.

Col. Moore, who as a contractor on many dredging operations, had never heard of any expansion or swelling of excavated material beyond 14 to 20 per cent., instead of 33, showed how in some cases the scow measurement actually ran short of the quantities *in situ* by the fact that in tidal waters, or with a greater or less strength or velocity of current keeping the loosened material in suspension, much of it was actually floated away, the current in such case doing a notable percentage of the work for which the contractor was being paid.

It was argued also in the case that the quantities were increased by the material introduced from some 100 acres of the city drainage; but it could not be shown that this would have given more than the fraction of an inch over the dredged area, as though some trifling sewer sediment might, under the velocity due to its coming from the city heights, reach the docks, the almost immediate reduction of this velocity to nought on reaching tidal level, would cause such sediment or material to settle down immediately, and short, by hundreds of feet, of the site of dredging operations.

Of course there is an expansion or an allowance which should be made over and above net quantities in estimating dredging and excavation of every kind; but this hinges in no way on swelling of the material to be taken out, but on the fact that such dredging or excavation can not be confined to the exact figure of the section, and there is of course a tendency in our human nature to overdo the thing a little or travel into side issues, when paid for by the yard at a good round paying price; as in tunnelling for the New York aqueduct, where the price per cubic yard of rock excavation was some $7, if the writer remembers well, holes were found in which a man could stand erect above the brick vaulting or lining of the tunnel, or between the extrados thereof and the top or roof of the excavated space.

That material thrown into embankment should give

a shrinkage of from 8 to 25 per cent. is of course not to be wondered at, when we consider for a moment the compacting effects of rain, the running away of the material by side rills and streams down the slopes of the dump, and that it is rarely given such breadth of base as not to allow of the material settling down to a greater ratio of base to height than that originally allowed.

But there are cases of refilling of excavated material where not only does the material filled in, and without any ramming down or consolidation, not leave a swelling above the normal level or surface of the ground, as it should to the extent at least of the material displaced by the sewer, drain or conduit of any kind, but where the stuff filled in actually falls short of the quantity required to fill the trench

This apparently paradoxical phenomenon, which the writer has often noticed during his extended practice and experience, and which has often been observed in wonder by non professionals, is due to the fact that the soil is loosened and swollen before it is excavated or cut into by frost and atmospheric agencies, in the same way as may be observed of the fall-ploughed and furrowed surface of a field during the ensuing spring.

Again, the earth is tunnelled into and through in all directions by worms, and honeycombed by foraminifera, so to say, though not of such microscopic dimensions as those we know of geologically; and to proof: the heaps of soil brought to the surface by ants and other agencies of the kind, as if the mounds raised by termites, honeycombed with their myriad nests, should be expected, if demolished and the material thrown back *in situ*, to rise again to the same height or swell to similar dimensions when all the living catacombs have been filled in.

That common earth may swell at first on being loosened and then be subsequently compacted into its original bulk, is due to the fact that the molecules or particles thereof being plastic and compressible, their parts are thus made to interpenetrate each other or to flow, so to say, into the vacant spaces between adjoining particles, just as certain substances may do, as oats and other elongated forms, when shaken, settle down and occupy less space by arranging themselves to fit the one into the space between the others; but the particles of sand being solid and incompressible, and all in contact on all sides with their neighboring fellows, they can no more be shaken or compacted into lesser bulk, except very slightly, so that such substances as spherical shot and peas, being in close contact, cannot be made to fit closer by any vibratory or impacting process.

The foregoing has not been written in any spirit of antagonism to the contractors or any of those connected with the work, nor as espousing either side of the question, but merely rehearses what has been brought out in evidence and here alluded to, and the matter discussed with a view to enlighten the profession and invite argumentation on a technical, important, and very much disputed subject of inquiry.

At the recent meeting of the National Electric Light Convention, in Cleveland, the committee on data read a very interesting report, and W. R. Gardener, one of its members, related his method of making a test of the Pittsfield station for the purpose of finding the ratio of the different items entering into the cost of developing energy. The items were as follows:—1st. Steam cost, including coal and water only. 2nd. Cost of engine, including wages of fireman, boiler repairs, interest on boiler room investment, fire and boiler insurance and depreciation of boilers, which is estimated at 5 per cent. 3rd. Cost at the switchboard, including wages of engineers, dynamo tenders, mechanic and wiper; repairs to electric plant, interest on steam electric plant and real estate, insurance on entire building and contents, oil and waste. 4th. Cost at lamp or motor, without depreciation, including the above, and general salaries, office expenses, cost of carbons, interest, incidental expenses, incandescent lamps, law expenses, oil and waste, steam and electric repairs, line repairs, taxes, wages, wiring and wiring supplies. 5th. Cost at the lamp or motor, including depreciation on total investment, which is placed at 5 per cent., but including drop in lines from station to lamp or motor. Taking the fifth item as the total cost, Mr. Gardener found the steam cost to be 33.8 per cent. of the whole; the cost at engine 6.8 per cent. more, or 40.6 per cent. of the whole; the cost at switchboard 26.4 per cent. more, or 67 per cent. of the whole; the cost at lamp or motor without depreciation 15.7 per cent. more, or 82.7 per cent. of the whole; cost at the lamp or motor, including depreciation on investment, 17.3 more, or 100 per cent. He called attention to the great importance of the first factor and advised the greatest care in the selection of coal and its economical use.

A MICROMETER ATTACHMENT.

W. T. Thompson, last month, presented before the Canadian Society of Civil Engineers a paper describing a new micrometer attachment for transit instruments. In connection with the transit telescope it affords the means of measuring with great accuracy small vertical angles between the limits of 0.8 and 3. It consists of a metal box firmly attached to the vernier plate of transit in a plane at right angles to the horizonal axis of telescope, and containing a micrometer screw, with divided head and vernier, and two movable nuts, and bears against a vertical clamping bar, being kept in close contact by a spring. The head of the screw is divided into 100 parts, and is read by the vernier to the $\frac{1}{1000}$th part of a revolution, and as each complete revolution moves the nut through $\frac{1}{40}$th of an inch, the $\frac{1}{1000}$th part will move it through the $\frac{1}{40000}$th of an inch, and as the length of the clamping bar from centre of axis to point of contact with nut is $6\frac{1}{2}$ inches, this will move the telescope through an angle of 0.8," which is the smallest that can be measured with this micrometer. The index nut is for recording the number of revolutions made by the screw; it has 20 threads to the inch, and the edge of box is divided into 20 parts to an inch, so that each turn of the screw carries the index nut through one division; therefore, in making any observation, the number of complete revolutions is read off from the scale, and any fractional part from the divided head and vernier. The clamping bar consists of two parts so arranged that the telescope may be moved in altitude either by the micrometer or by the ordinary tangent screw, so that when desired the micrometer may be set at zero or any reading, and the telescope accurately set on any object by the tangent. In measuring distances with this micrometer, the writer has used for a base a light round rod 30 links in length, about 2 inches in diameter at the bottom, tapering to 1 inch at the top, and provided with a universal spirit level to ensure verticality, with three targets, one 5 links from the bottom,

one 10 links above this, and one at top of rod, giving a clear distance of 25 links between the outside targets. The targets were formed of bright tin, and black rubber tacked on the rod. The tin reflecting light and the black rubber absorbing it, the division between them was very distinct. The lower targets, 10 links apart, were only used in measuring short distances, the outer targets, 25 links apart, being used in all other cases. If a distance of say 40 chains be measured on a piece of level ground or upon the ice, and the number of turns of the micrometer screw required to move the horizontal wire of the telescope from one target to another be noted, then as the base is very short as compared with distances to be measured, it may be considered to represent the arc which subtends the angle at the instrument, and this angle will vary inversely with the radius or distance. As, however, at different distances from the instrument the difference of refraction of the targets will vary slightly, it is necessary, in order to prepare an accurate table for reducing the observed readings to distances, to notice the actual readings at each chain of distance from 5 chains up to 50 chains, and interpolate the readings for differences of 10 links. The distances corresponding to any observed readings can then be at once obtained by inspection. To determine differences of level and establish grades on preliminary railway and other surveys, the telescope must be provided with a good spirit level, and the horizontal wire adjusted to define a horizontal line when the bubble is at zero. Then if we note the point on a rod at the distance of say 500 feet where this line strikes, and turn the micrometer screw through one revolution, the distance between the two points on the rod being measured, 1-5th of it is the rise or fall in 100 feet for one turn of the screw, and we can now prepare a table giving the number of turns required for various grades, also of the rise or fall in feet at different distances; these tables should include the effect of curvature and refraction. We also require a target rod consisting of two pieces sliding upon each other, in order that the piece carrying the targets may be pushed up or down, so that the lower target can be set at the height of the telescope above the ground, and clamped in position. The distance between the targets may be 5 or 6 feet, and a table for reducing observed micrometer readings to distances can be prepared in the manner already described. We are now prepared for surveying and obtaining the levels and distances along any preliminary line without the use of the chain or any other instrument. The mode of proceeding will be as follows: The instrument being set up at the starting point of the survey, and carefully levelled, the direction of the line is fixed by readings of the horizontal circle, the bubble of telescope level brought to zero and reading of micrometer noted, then the lower target being adjusted to the height of the telescope, the rod-man proceeds along the line and holds the rod at all points where any marked changes of inclination occur, the distance to each point being determined from readings on the targets; also the difference between the micrometer reading for level zero and the reading on the lower target gives the difference of level by consulting our table. We may also obtain the direction, distance, and difference of level of points on either side of the line referred to the Instrumental Stations, and without planting any stakes except at these stations, collect the necessary data for preparing a plan, profile and cross sections of the line, from which a location can be decided on, which would then be chained, staked and levelled in the usual way.

THOMAS MONRO, PRESIDENT CANADIAN SOCIETY CIVIL ENGINEERS.

Thomas Monro, President of the Canadian Society of Civil Engineers, is an Irishman by birth, and came to Canada in 1850. He was immediately employed under Thomas C. Keefer on various surveys—Montreal and Kingston Railway, St. Lawrence Bridge (now the Victoria), Montreal water works, etc., until 1854. From 1854 to 1856 he had charge of a portion of the G.T.R. construction at Prescott. From 1857 to 1859 he was assistant engineer on the Hamilton waterworks, and resident engineer on the Hamilton and Port Dover Railway. From 1860 to date he has been in the service of the Canadian Government as an engineer. During this period of over 35 years Mr. Monro has been engaged in some very important works, a *resumé* of which is as follows: In 1863 he was appointed one of the Government inspectors of railways, and in 1864 specially sent to report on the best means of supplying water to the Parliament and Departmental buildings at Ottawa. In 1868-9 he examined the east coast of Lake Huron and north shore of Lake Erie, with a view to the establishment of harbors of refuge, and also made a partial examination of the east end of the Dawson route as a proposed means of water communication with the interior. In 1870-71 he located the present new Welland Canal. The next year he was appointed engineer in charge of the Welland Canal enlargement between the lakes. This work was, however, subdivided, and Mr. Monro superintended the construction of the new line of canal north of Allanburg, on which all the lift locks are situated, and remained in charge up to the end of 1888, the canal being deepened to 14 feet. In 1889 he was specially sent by the late John Page to survey and report upon the question of locating a new canal between Lakes St. Louis and St. Francis. After much opposition this canal, named by Mr. Monro the "Soulanges Canal," is now in course of construction on the line recommended by him, and from his designs and specifications. Several important changes have been made in the plans of locks, weirs, etc., which it is believed will result in facilitating the passage of large vessels, and, by the general introduction of concrete, reduce the cost of the works. Mr. Monro has

also demonstrated by experiment the feasibility and economy of operating the locks, weirs, etc., with electrical apparatus, an account of which appeared in THE CANADIAN ENGINEER last year. In 1891 Mr. Monro was sent by the Government to England to examine and report upon the Manchester Ship Canal. He is at present engaged, with other Government engineers, in looking into matters connected with the improvement of the harbor of Montreal. Mr. Monro designed and constructed the waterworks at St. Catharines and Merritton, Ont., and reported on systems for Simcoe, Clifton, etc. He has had extensive experience in subjects connected with hydraulic engineering. He is a member of the Institution of Civil Engineers, and was elected President of the Canadian Society of Engineers for 1895, at its last annual meeting. Mr. Monro's professional career was the subject of a complimentary biographical sketch in *Cassier's Magazine* for November, 1892, written by F. Houghton, to whom the writer is indebted for some of the facts contained in this notice.

ASSOCIATION OF ONTARIO LAND SURVEYORS.

The first steps towards organizing the Association of Ontario Land Surveyors were taken in the latter part of 1885, and were initiated by Willis Chipman, C.E., then of Brockville, who entered into correspondence with representative members of the profession in different parts of the province. As a result, a meeting was held at the old Parliament buildings in Toronto, on 23rd February, 1886, the conveners being Otto J. Klotz, Preston; G. B. Kirkpatrick, Toronto; T. Harry Jones, Brantford; Jno. M. Moore, London; P. S. Gibson, Willowdale; G. B. Abrey, Toronto; M. J. Butler, Napanee; Lewis Bolton, Listowel; Prof. Galbraith, Toronto; Alex. Niven, Haliburton; and Edgar Bray, Oakville. At this convention a constitution and by-laws were adopted and officers nominated. It was decided to hold annual meetings of the association, at which papers on various topics of interest to the profession should be read, and the whole proceedings of the meetings published in the form of annual reports. Thus was the association launched, not without some misgivings as to its future, as many, particularly among the older members of the profession, held aloof and looked upon it as an ephemeral institution. The steady progress of the association has shown that these misgivings were ill-founded.

Under the by-laws, standing committees were annually appointed by the council to have charge of the following branches relating to the interests of the association, viz., land surveying, drainage, engineering, legislation, instruments and publication. A standing committee on entertainment was afterwards added, as, since the year 1887, the annual dinner has been recognized as not the most uninteresting feature of the meetings. The association began with a membership of twenty-five, which was increased during the first year to seventy, and during the years preceding incorporation to one hundred and twenty.

In 1891 it became apparent that the time for incorporation had come, and steps were taken with that end in view. A bill was drafted and submitted to the Hon. Commissioner of Crown Lands, who, being convinced that the proposed Act was in the interests of the public, introduced it as a Government measure. This bill, with a few amendments, received the royal assent on the 14th of April, 1892, and the association became a body corporate, having perpetual succession and a common seal, with power to hold real estate and to pass by-laws, not inconsistent with the Act, for the: (*a*) Government, discipline and honor of its members. (*b*) Management of its property. (*c*) Examination and admission of candidates for the study and practice of the profession. (*d*) And for all such other purposes as may be necessary for the working of the corporation.

The management of the affairs of the association is vested in a council consisting of the Commissioner of Crown Lands, a president, vice-president and six other elective members.

The president, vice-president and secretary-treasurer are elected annually, while the councillors hold office for terms of three years, two members being elected in each year. The meetings of the council are presided over by a chairman of council, who is annually elected by the council from among its members, and who is also *ex-officio* chairman of the board of examiners.

The board of examiners is composed of the chairman of council and six other members, of whom two are appointed by the Lieutenant-Governor-in-Council and four appointed by the council of management, each member thus appointed holding office for three years. The secretary-treasurer of the association is also *ex-officio* secretary of the board.

Since incorporation the membership of the association has steadily increased, and now includes all the legally practising land surveyors in the province. There are now 213 active members and 42 who have registered and withdrawn from practice.

With the exception of the city engineers of Toronto and Ottawa, every city engineer in the province is a member of the O. L. S. Association, and nearly all town and county engineers in Ontario are also members.

The board of examiners is composed of the following persons: M. J. Butler and G. B. Kirkpatrick, appointed by Lieutenant-Governor in Council, and P. S. Gibson, A. Niven, M. Gaviller and R. Coad, appointed by the council of management, the chairman being Mr. V. Sankey.

Candidates for admission to apprenticeship are examined on the following subjects: Penmanship, Orthography, Arithmetic, Logarithms, Algebra, Euclid, Trigonometry, Mensuration and Drawing.

Candidates for admission to practice are examined as follows: Geometry, Algebra, Plane and Spherical Trigonometry, Mensuration, Descriptions, Use and Adjustment of Instruments, Laying out of Curves, Practical Astronomy, Survey Act, Mining Act, Municipal Act, Registry Act, Ditches and Water Courses Act, Levelling, Principles of Evidence, Taking of Field Notes, Preparing Plans, Geology and Mineralogy.

The majority of candidates for the final examination during the past few years have been graduates of the Ontario School of Practical Science, McGill University and the Royal Military College.

Within the last year a large room has been secured for the exclusive use of the association, with a vault attached, and has been fitted up as a library and repository.

The association collects books, plans, pamphlets, field-notes, diaries, etc., and any other documents pertaining to the early surveys of Canada, also instruments of early manufacture. Biographical sketches of the

early surveyors are also being received, and each volume of the Proceedings contains a portrait of one of the prominent pioneers of the profession.

Two important questions are now being grappled with by the association. (1st) A topographical survey of the southern part of the province based upon a geodetic survey. (2nd) A thorough exploration of the north half of Ontario and the country beyond. Eventually both efforts will doubtless be crowned with success.

The following list shows the officers from the beginning:

List of Officers 1886 to 1892 (before incorporation).

Officer.	1886-7.	1887-8.	1888-9.	1889-90.	1890-1.	1891-2	1892 (to 1st July.)
President	G. B. Kirkpatrick.	G. B. Kirkpatrick	A. Niven.	A. Niven.	V. Sankey.	V. Sankey	E. Stewart.
Vice-President	John Galbraith.	John Galbraith	V. Sankey	V Sankey	E. Stewart.	E. Stewart.	M. J. Butler
Secretary-Treasurer	Willis Chipman.	Willis Chipman	Willis Chipman.	Willis Chipman.	A. J. VanNostrand.	A. J. VanNostrand	A. J. VanNostrand.
Councillors	M. J. Butler.	M. J. Butler	John McAree.	E Stewart	H. B. Proudfoot.	M. J. Butler.	John McAree
	E. Stewart.	V. Sankey	H. B. Proudfoot.	John McAree	M. Gaviller.	H. B. Proudfoot.	M. Gaviller
	Villiers Sankey	P. S. Gibson.	W. R. Aylsworth.	P. S. Gibson.	T. H. Jones.	M. Gaviller.	P. S Gibson.

List of Officers 1892 to 1896 (since incorporation).

Officer.	1892-3.	1893-4.	1894-5.	1895-6
President	E. Stewart	E. Stewart	M. J. Butler.	M. Gaviller.
Vice-President	M. J. Butler	M. J. Butler	M. Gaviller.	Willis Chipman.
Secretary-Treasurer	A. J. VanNostrand	A. J. VanNostrand	A. J. VanNostrand.	A. J. VanNostrand.
Councillors	Hon. A. S. Hardy.	Hon. A. S. Hardy	Hon. A. S. Hardy.	Hon. A. S. Hardy
	P. S. Gibson.	G. B. Kirkpatrick	V. Sankey.*	V. Sankey.
	M. Gaviller	A. Niven	H. J. Bowman.	H. J. Bowman.
	John McAree	P. S Gibson	G. B. Kirkpatrick.	G. B. Kirkpatrick
	V. Sankey*	M. Gaviller	A. Niven.	A. Niven.
	A. Niven	J. McAree	P. S. Gibson.	and two others, to be
	G. B. Kirkpatrick.	V Sankey*	Willis Chipman.	elected in April.

* Chairman of Council.

THE TAYLOR HYDRAULIC AIR COMPRESSING SYSTEM.

The demand for greater economy in power supply has of late years turned the attention of thinking men to compressed air as a means to this end, and, as intimated in our last issue, it has fallen to the lot of C. H. Taylor, of Montreal, a practical miner and mechanical engineer, to be the first to perfect a system of air compression, which preliminary tests indicate to have all the features to commend it to the attention of anyone within a reasonable radius of a natural water power.

The first attempts to utilize compressed air for locomotive purposes were made as far back as 1850, but were unsuccessful; and it was only in 1872 that a French engineer, M. Mékarski, made a study of the problem. His researches, based upon laws of thermodynamics which were new at that time, led to a result that was at once a success.

In the compression of air by mechanical compressors, where the initial force is generated by steam or turbine wheels, the loss of energy between the initial force and point of application has been such as to materially limit its sphere of usefulness, while the necessity for keeping the mechanical parts in perfect repair greatly added to the cost of production. So much has this been the case that, until recently, the use of compressed air as a transmittable power has been limited mostly to mining operations, where it becomes a necessity.

Another feature operating against the mechanical compressor as an economic power-producer is the heating of the air in compression, and subsequent loss in shrinkage by cooling in course of transmission. To partially obviate this two methods have been adopted, one by the use of cooling jackets round the cylinder, and even in the piston, which is only recommended for mining plants; the other by the injection of a spray of cold water, which is better adapted to the purposes of a central compressing station. This also has its disadvantages, as the small particles of water produced by the spray are further subdivided by the heat caused by the compression, and add to the natural moisture of the air. To insure the fullest possible efficiency it is also necessary that all automatic valves, pistons, etc., be kept in absolutely perfect working order, necessitating the services of skilled labor of the highest order.

The natural moisture in the atmosphere, when taken into the compressor, increases in proportion as the air is compressed, and the greater the compression the greater the heat which holds this moisture in suspension, until it reaches the transmission pipe, where it undergoes condensation by contact with the cold iron, which, in winter, in cold climates such as ours, is a prolific source of trouble through the freezing up of the air pipes.

Notwithstanding these drawbacks a wider field of usefulness for compressed air has been opened up by its adoption as a motive power on some of the tramway lines in Paris, France, and Berne, Switzerland.

In *Le Monde Moderne* for February, M. E. Bougenaux gives a full description of the whole system, from which we learn that the motors are of two sorts, one being simply locomotives drawing several ordinary cars, and motor-cars carrying passengers. These motors carry the compressed air in sheet steel tanks which are charged at the power stations with sufficient air at a given pressure to enable them to run a certain

distance before being re-charged, and "may be compared to a watch which, after being wound up, distributes the accumulated force to make the hands move for a certain time." The machinery at the central power stations is somewhat complicated and consists of a saturating heater or boiler, through which the air is forced with a view to heating it, thereby counteracting the tendency to freeze on expansion. The plant is composed of machinery to create power, apparatus to compress the air, reservoirs to accumulate the air, and devices for loading and piping the air.

As a general rule steam is used as power to compress the air, but in one instance at Berne, Switzerland, natural waterfalls are used in conjunction with turbine wheels.

Notwithstanding all this machinery it has been found to work satisfactorily and economically, and it is claimed that the cars are light and clean, allow no smoke or steam to escape, are noiseless, and do not frighten horses. There is no danger of explosion as from the starting point the pressure always becomes less and less. They can be stopped suddenly if required, as one motion only is required to transfer the power from the motor to the brake. M. Bougenaux concludes his description with a comparison of the cost, and says:

"It has been calculated that the expense will not exceed 0 fr. 27 per car on the line between the Louvre and St. Cloud and Versailles; 0 fr. 42 on St. Augustin-Vincennes, and 0 fr. 26 per car for trains of two cars.

"These figures are interesting when compared with the result of the 'Omnibus et des Tramways Nord':—

"Traction by horses (omnibus, 1893). 0 fr. 64

"Traction by electric storage battery 0 fr. 52."

In the Taylor system all the objectionable features seem to have been overcome or reduced to a minimum with the best results.

Briefly stated, the air is compressed by the direct action of falling water without the aid of any moving machinery, and practically without expense for maintenance or attendance after installation.

By this system any fall of water varying in working head may be utilized, and any pressure required can be produced and uniformly maintained up to the capacity of the water power, delivering the compressed air at the temperature of the water, and in a drier state than is possible by any known means of compression, thereby avoiding all loss by condensation or shrinkage by cooling of the air after compression.

For a better understanding of the system, we would refer the reader to the accompanying diagrams.

The water may be conveyed to the compressor by means of an open flume; or, as shown in the diagram, through a pipe supplying a tank or stand pipe round the headpiece of the compressor, where it can attain the same level as the water in the dam or source of supply.

Around the headpiece are placed a large number of small, horizontal air-pipes, drawing their supply of air through larger vertical pipes, which extend above the surface of the water and open to the atmosphere.

As the water enters the down flow pipe and passes the ends of these small air pipes, it draws in the air in the form of small uniform globules, which, becoming entangled in the descending water, are carried down to the receiver at the bottom of the pipe, compressing the air by the pressure of the water surrounding these globules until they reach the point of separation. This pressure is maintained so long as there remains any air in the receiver.

The receiver is sufficiently large in diameter to allow the air to rise to the surface of the water therein, from whence it is taken through the air pipe for transmission to be utilized as power or for other purposes. The water, being kept down by the pressure of the air, is forced out through the open bottom of the receiver and up the shaft around the down-flow pipe to the tail race level.

The compressor is so constructed as to permit of its being regulated to furnish any proportion—from one-third of its capacity—using water proportionately with a like efficiency.

As already stated, a most remarkable feature of this system is that, notwithstanding that the air is compressed by the weight of the water and in actual contact with it, the air so compressed is delivered in the receiver and thence to the transmission pipe drier than when drawn in from the atmosphere.

At first sight this would seem impossible, but it is well known that in a high temperature moisture is held longer in air than in a lower temperature, hence the contact of the air globules with the cold water keeps down the temperature usually caused by the compression of air, and the atmospheric moisture held in the globules condenses, as it were, on the walls of these globules, and at the point of separation the air and water are absolutely separated, leaving the air all ready for distribution at the same temperature as the water it has just left, and drier than when first taken in through the small air pipes.

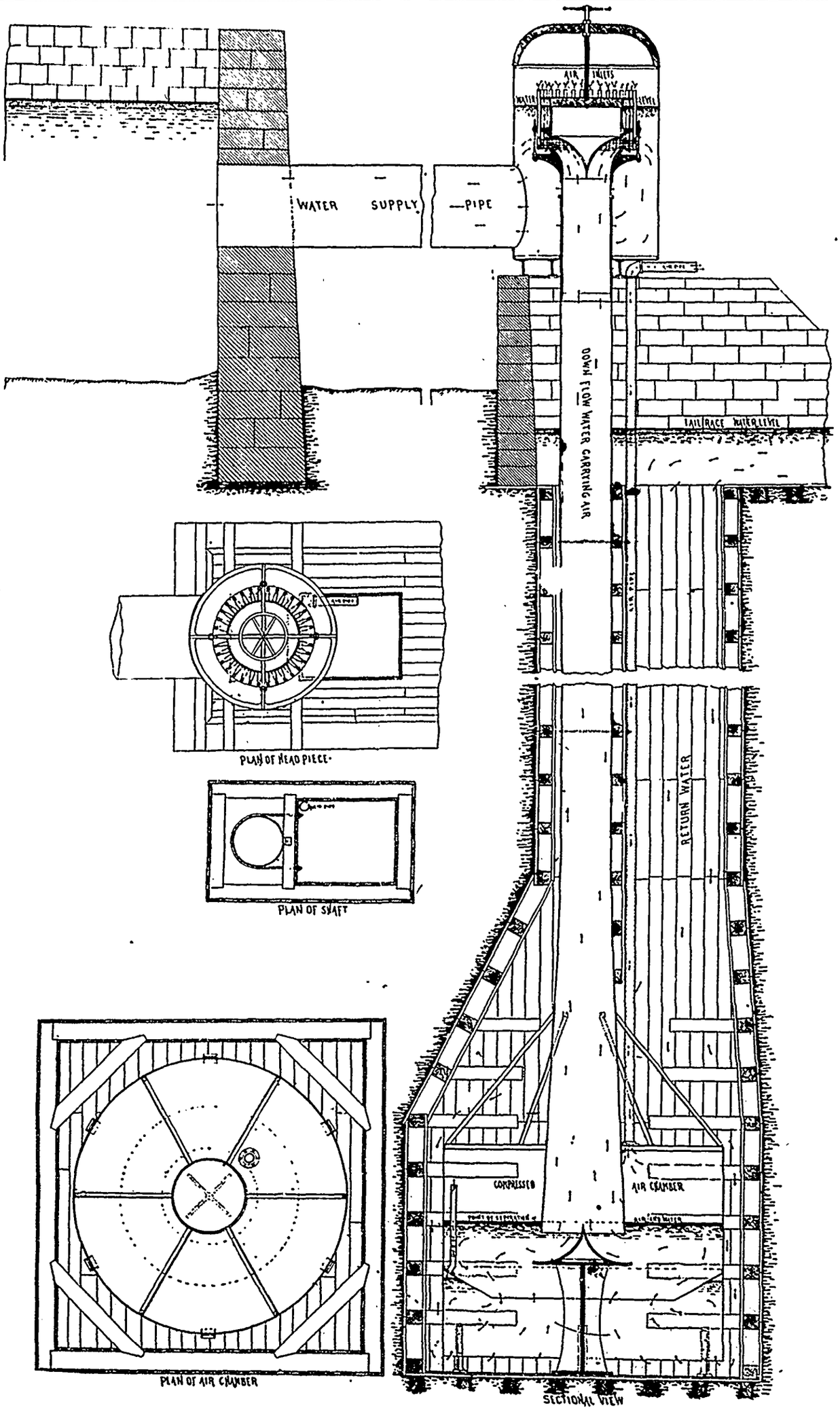
Another feature is that the power of the water can be converted into compressed air at any pressure per square inch, giving the same efficiency at either high or low pressure with a far less loss of energy than by any other process of transforming a water power into transmittable force, and with unvarying pressure.

Should the volume of air taken down be greater than that being used, it accumulates in the receiver until it forces the water below the lower end of the receiver, and the surplus passes up with the return water, thereby forming a perfectly automatic safety valve, without requiring any attendance whatever. It will be observed that the material used in the construction of the down-flow pipe need only be of sufficient strength to carry the weight of water and pressure generated in the working head of the water power, as once it reaches the tail race level the internal pressure is gradually neutralized from that point down by the pressure in the return water surrounding the down-flow pipe; so that any pressure almost may be reached without increasing the strength of the down-flow pipe. The material for the down-flow pipe may be of iron, or wood hooped with iron, and the shaft may be constructed of the cheapest of timber; and as it is preserved by being constantly in the water, there is practically no limit to its durability.

By this system low falls, otherwise useless, may be utilized, and the same pressure obtained as from high falls, the horse power being determined by the diameter of the down-flow pipe, and the height and volume of water in the fall, while the pressure depends solely upon the depth of the well or shaft, therefore any desired pressure can be obtained.

By reference to the diagram it will be noticed that the head piece is telescoped into the down-flow pipe, and raised or lowered by means of a hand wheel on top, thus permitting the flow of water to be regulated, or to lift it above the water level and stopped entirely, and

TAYLOR HYDRAULIC AIR COMPRESSOR.



by means of side screws or bolts the area of the inlet to the down pipe may be increased or diminished, so as to regulate the speed of the water past the end of the air pipes, and then fixed at the most efficient working point. At the bottom of the down-flow pipe is an upright cone which turns the course of the water towards the circumference of the receiver, thus facilitating the escape of the air from the water, while round the circumference, to turn the course of the water back towards the centre, as indicated by arrows, is a deflecting apron under which any air then in the water is caught and conveyed through a small pipe to the main body of air in the receiver.

The whole system is fully protected by patents and is controlled by a joint stock company, and charter applied for under the title of the "Taylor Hydraulic Air Compressing Co., Ltd.," with a capital of $500,000, and headquarters at 183 St. James St., Montreal. The gentlemen composing the company, before finally acquiring the rights, submitted the models of different sizes to Prof. John T. Nicolson, Professor of Mechanical Engineering and Thermodynamics of McGill College, who submitted them to one hundred and nineteen tests, extending over a period of six weeks, and concluded his report to these gentlemen with these words:—

"I must admit that any prejudices or doubts I may have had (some of which I expressed in conversation) regarding the feasibility of the undertaking, have now completely disappeared, and I entertain a most favorable opinion of the merits of Mr. Taylor's system."

THOSE receiving a sample copy of this number, and intending to subscribe, should forward their names at once in order to get the coming volume complete.

DURING the last twenty years the number of iron foundries and machine shops has greatly increased in India, and the country is less dependent on Europe for general ironwork. The following is a list of such structures of iron and steel as are built in India: Coasting and river steamers, launches, barges, steam boilers, bridges, tanks, piers and jetties, sluice gates, buildings, engines, steam pumps, turbines, sugar-crushing machinery, oil mills, cotton, hay and other presses, and grinding mills. The railway companies build their own rolling stock, but they import the wheels, axles, tires, and other iron work; rails also are imported, as are also steel sleepers, which are much in vogue in place of timber. Bolt, chain, and rivet making are not yet known as separate industries. Wire working is a steadily-increasing industry, being readily taken up by the natives. Locks, of fairly good quality, are made in Bombay and Calcutta, but none of the manufacturers appear to possess a key-cutting machine, or a good set of machine tools Machine tools are made, but in small quantity, most of the tools being imported. Textile machinery is entirely made in England. Agricultural implements are in small demand, on account of the poverty and ignorance of the cultivators. India possesses only one glass factory conducted on European methods, and this is in Calcutta. There are a few smaller glass factories, but when they do not use broken imported glass, they turn out goods of an inferior quality. Good glass materials are to be found in India, and a factory for the manufacture of soda-water bottles alone would, according to American Consul Sommer, of Bombay, find occupation for a large number of operatives. Window glass is now largely used throughout India, where only shutters were used before. It is obtained principally from Belgium. In brick and tile-making there are few factories having the appliances for making bricks by machinery. The tiles most in use are of native design and manufacture. A tube of clay is spun by hand on a very simple wheel made of wood and balanced and loaded with clay. It turns on a peg, and having been set in motion, it revolves long enough for the operation. The tube, which is tapering in form and about four feet long by about four and a half inches wide, is split by a piece of string into halves, which, when dried and burned, become the country tiles of India. One layer with edges up and one layer with edges down is what is termed a single tiling. No fastenings are used, there being only one support at the eaves of the roof to prevent them from slipping off. In large towns the European pattern of tile is coming into vogue. The greatest number of European tile factories in India are in Malabar and South Canara, where water carriage along the coast affords a cheap means of transportation. The factories are closed during the rainy season. Oil has been expressed for many centuries by the *ghanee*, a mortar, having a revolving pestle driven by hand or bullock power. The residual cake contains a large quantity of oil and is used as food for cattle. This mill is still in general use, excepting where Europeans have a hand in the production, European machinery, of course, giving better results. Until six or seven years ago vegetable oils were almost exclusively used for every kind of lubrication in India. At first mineral oils made a bad impression, but this was soon removed. *Ghee*, a clarified butter used by the natives, is adulterated with vegetable oils and animal fats.

THE tenth annual convention of the National Electric Light Association, which took place at Cleveland, Ohio, on the 19th, 20th and 21st of February, as might be expected, proved a very interesting event, and was a great success from start to finish. A notable feature was the presence of three great pioneers of electric lighting, Brush, Houston and Thomson, and one of the most interesting parts of the convention was the address delivered by Mr. Brush. Among the papers read and discussed were "The Storage of Energy Essential to the Economy of Working in Central Stations," by N. W. Perry; "A New Method of Measuring Illumination," by Prof. Houston and A. E. Kennedy; "The Correct Method of Protecting Electric Currents," by W. E. Harrington; "Large Arc Dynamo," by C. N. Black; "How to Light Large Cities," (topic); "The Monocyclic System," by Louis Bell; "Practical Demonstration of Protecting Lines from Lightning," by W. A. Wurtz; "Arc Carbons and the Rating of Arc Lamps," by L. B. Marks. The new president of the Association is C. H. Wilmerding, general superintendent of the Chicago Arc, Light and Power Co. Among the visitors from Canada present at the convention were A. J. Corriveau, of the Montreal Park and Island Railway Co., and J. A. Kammerer, of the Royal Electric Co., Montreal.

PILE DRIVING.

Major Henry A. Gray, C.E., Toronto, commenting on H. F. Perley's valuable paper on "The Resistance of Piles," referred to in our February number, says that recently quite an improvement has been made in the method of driving piles.

Two years ago extensive pile-driving was done by the Department of Public Works of Canada as protection work, when widening the River Sydenham, at Owen Sound, to increase the harbor area. Previous work at this place had shown the difficulty of driving piles through the sand and other compact material found at this place, sufficiently long to allow the lower ends to be below the depth required to be dredged in the harbor. A very clever mechanic, a partner of the firm of contractors for the protection work—Captain James Canan—consulted with Major Gray and conceived the idea that he could improve upon the method of using a jet alongside the pile, while being driven, to displace the material through which the pile had to pass, and, in fact, construct a machine which would *bore the hole* for the pile, and before the hole thus bored could fill in, insert the pile in place and to its required depth. After several trials Captain Canan succeeded beyond all expectations, and, as a result, the following facts will be of interest:

Fender piles of rock elm, 40 feet long, 12 x 12 inches square, with ordinary pile-driving machine—*i.e.*, ram 2,000 pounds weight, fall 20 feet, pile pointed and iron ring placed around head—after 200 blows, given in from 35 to 40 minutes, split below the ring, and a piece one foot in length had to be cut off the top of the pile and the ring replaced; after fifteen more blows the pile could not be driven any further, and three feet three inches still remaining above the proper height of the pile work had to be cut off.

With the use of the boring machine the same sized pile, viz., 40 feet long, 12 x 12 inches square, passing through the same material, was put down its *full length*, without use of ring, in three minutes, perfectly perpendicular, in line, and close up against the other work, and to exactly the required height, with nothing to cut off top; only the weight of the hammer resting on the head of the pile, at first, and then settling into its full depth, a few blows given, the hammer not being hoisted more than 2 feet in the leaders, completing the work. Eighty to one hundred piles, penetrating 20 feet in depth, have been driven by this method in one working day of 10 hours.

It may be remarked here, for comparison, that the U. S. Army Engineers (Vol. 1889, part 4) give a day's work of pile-driving, with use of jet, material, sand, with pockets of gravel, average penetration 18.9 feet, as from 20 to 34 piles.

With respect to that portion of Mr. Perley's paper in which he gives the power of ice adhering to and surrounding a pile to raise it by the influx of water underneath—acting as a platform—Major Gray states that having had considerable difficulty to keep a level railway track on a pile-bent structure at Catalone Lake, Cape Breton, from the same cause, he inverted the piles and by this means reduced the friction upwards (or adhesion), and the ice becoming free, thus prevented the piles from being disturbed.

Mr. Canan describes his machine as follows:—

The object of the invention is to design a simple machine which will rapidly bore into soil under water; and it consists essentially of a shaft to which a turbine and an archimedian screw are fixed and contained in a casing supplied with water under pressure, and having openings arranged in such a manner that the water forced into the said casing will, in escaping, act upwardly against the soil loosened by cutting blades fixed near the end of the shaft, substantially as hereinafter more particularly explained.

Figure 1 is an outside view of my improved boring machine, partially broken away.

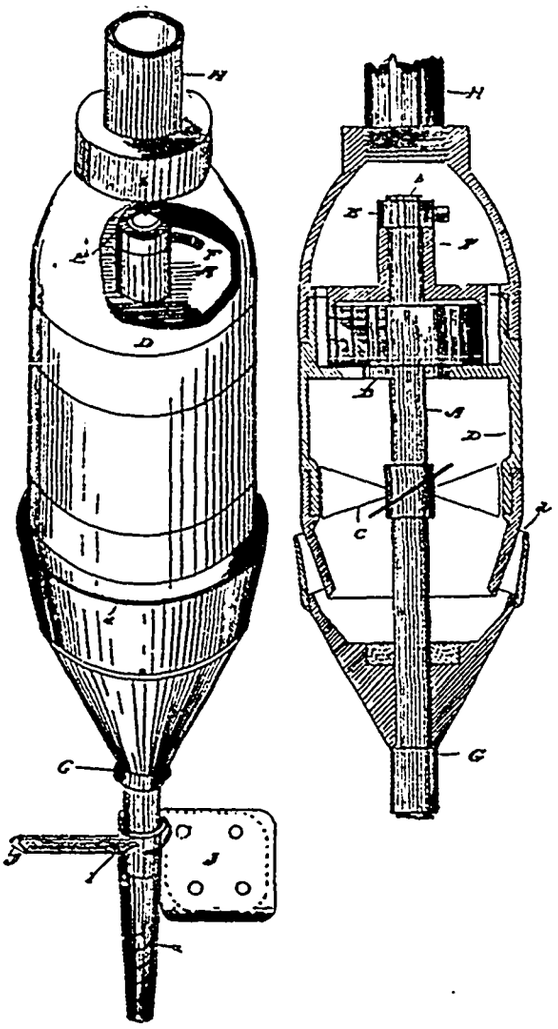


FIG. 1. FIG. 2.

Figure 2 is a sectional elevation of the same.

A represents a shaft, to which a turbine, *B*, and a propeller or archimedian screw, *C*, are fixed. A casing, *D*, is arranged, as indicated, to contain the turbine, *B*, and propeller, *C*. A collar, *E*, clamped on the shaft, *A*, rests upon the step, *F*, formed within the casing, *D*, as indicated. Suitable bearings are otherwise provided for the shaft, *A*, so that it can be made to revolve freely. A collar, *G*, clamped to the shaft, *A*, butts against the end of the casing, *D*, so that with the collar, *E*, the shaft, *A*, is securely held, so that it cannot move vertically within its casing, *D*. *H* represents a piece of gas pipe, by which the casing, *D*, is connected to a powerful pump. I cut or form a coarse screw, *a*, on the end of the shaft, *A*, and a little above the said coarse screw I fix to th. said shaft, *A*, a two-blade cutter, *I*, the blades being set at such an angle that they will not only cut into the soil against which they are pressed, but will elevate the loosened soil so cut. I provide steel plates, *J*, which are detachably connected to the blades of the cutter. These plates are sharpened, and in fact form the cutting edges of the cutter, *I*. They are made detachable, so that they can readily be removed to be replaced by new ones when they are worn out, or when they require sharpening. The water which is forced into the casing, *D*, under a high pressure, passes into the hollow shaft, *A*, through its open end, *b*, and thence through the hole at its bottom end,

and as the water is thus forced through at a very high pressure, the water escaping through the bottom end of the shaft, *A*, acts upon and excavates the soil into which the said shaft penetrates. The water which does not pass through the shaft, *A*, is forced through the turbine, *B*, thus causing the said turbine to revolve, and as the turbine is fixed to the shaft, *A*, the shaft also revolves and carries with it the cutters, *I*, which quickly cut and excavate the soil into which the machine penetrates. After the water has passed through the turbine, *B*, it immediately comes in contact with and is acted upon by the propeller or archimedian screw, *C*, so as to increase the pressure against the water and force it through the opening, *d*, formed around the casing, *D*, as shown. The water thus forced through the opening, *d*, acts against and forces upwardly the soil loosened by the cutters, *I*, and by the water forced through the end of the revolving shaft, *A*. In this way my boring machine quickly penetrates the soil under water, and makes a perfect hole to receive the pile it is intended for.

I may mention here that I prefer to make the hole slightly smaller than the pile it is made for, so that the said pile may be gently tapped into position, and be a good solid fit for the hole. Should the machine encounter rock, I provide a diamond drill which may be readily attached to the end of shaft, *A*. As I do not claim anything in the mechanism for raising and lowering my boring machine, it is not necessary to describe or show any mechanism in this specification. It will be sufficient to say that suitable mechanism must be provided by which my boring machine may be readily lowered to the bottom of the water and as easily withdrawn after it has performed its work. It is also necessary to provide simple mechanism by which the pile may be easily lowered and guided into the hole prepared by the said boring machine. Although I consider that a turbine wheel connected to the shaft, *A*, and operated by water, will be the best means for revolving the said shaft, it would of course be possible to drive it by means of steam or gearing, in which case the turbine would be dispensed with, and the other power substituted.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

READABLE REPORT FROM BRO. EDKINS.

Editor CANADIAN ENGINEER:

DEAR SIR,—On Feb. 13th last I visited Brockville No. 15, C.A.S.E., and found that branch progressing very favorably under the direction of W. F. Chapman, their energetic president On the night in question it happened to be "Educational Night," and I had the pleasure of seeing several of the members do some good work on the blackboard, and also indulge in some hearty discussions. One thing struck me very forcibly as illustrating the educational benefits to be derived by engineers from membership in the C.A.S.E., viz., I saw several members figure out the heating surface of a given size of boiler, and the h.p. of an engine, who could not do simple multiplication when they joined the association. Brockville No. 15 have a hall to themselves, and have furnished it comfortably, and meet generally twice a week. Bro. Chapman, the president, is very popular with the members, and deservedly so, for he devotes a large portion of his time and energy to their interests.

I also visited Kingston on Feb 15th, and had a talk with the leading members This association now has a membership of over 40, and has held very instructive and interesting meetings during the winter.

Being in Guelph a few days ago, I called on Bro. C. J. Jorden, and was pleased to learn that No. 6 is beginning to show signs of increased activity again.

I would particularly ask the secretaries of associations in my district to report their meetings and all matters of interest to engineers happening in their several localities to THE CANADIAN ENGINEER, and also to take the trouble to see that their associations are correctly reported in the directory, with the proper names of officers attached. A post card will put this matter right at any time.

If the engineers in any town where there is no association would like to organize, and will write me, I shall be glad to furnish all particulars.

Yours very truly,

E. A. EDKINS,
Prov. Deputy, Ontario

Toronto, March 25th.

HOW HAMILTON HOLDS OUT.

Editor CANADIAN ENGINEER:

At our last meetings considerable business of importance was transacted, and a good number of interesting discussions actively indulged in. Among the most important subjects was "The Requirements of an Engineer" at different plants, and what kind of a man is required as engineer. This discussion arose upon the appointment of the two representatives to wait upon Sir Oliver Mowat in connection with the bill asking the Government to grant an inspection and license law, and the members of this lodge were very much pleased with their report upon their return home. We intend holding our annual supper on Good Friday Eve, at the Commercial Hotel, same place as last year, and it is unnecessary for me to say that all attending will have a good time.

WM. NORRIS, Cor.-Sec.

Hamilton, March 21st, 1895.

ODD ITEMS FROM OTTAWA.

Frank Merrill, of Ottawa, has passed the examinations of the Stationary Engineers' Association for a first-class certificate. Steven Martin, of Kars, has passed for a third-class certificate. Frank Robert, of the Ottawa branch of the association, conducted the examinations. The members of the association in Ottawa are still discussing the many advanced ideas on "heat," expressed by A. M. Wickens, chief engineer of the Government buildings at Toronto, in a recent address before the Ottawa branch of the Stationary Engineers' Association. Ottawa engineers are anxiously watching the bill now before the Ontario Legislature, making the examination of engineers compulsory.

THE ALLARD PROCESS OF HARDENING COPPER AND ALUMINUM.

Correspondence of CANADIAN ENGINEER.

Answering to your request of the 6th inst., for information as to the Allard process of hardening, tempering copper, aluminum, and referring me to the Citadel, Quebec, for the result of a recent test of what I understand from the makers of the gun to have been of aluminum, but which the report—copy of which I append—says to have been of copper—I beg to say that, desirable as it would be that the old secret of tempering these softer metals had been re-discovered, and by one of our own countrymen, I can find nothing tangible on the subject. I have written Allard himself, and Carrier, Laine & Co. Their silence portends "Nothing to say."

Now, as to the test of the gun, which as you will see by the report was only a twelve-inch one, with a ½ inch bore, and ½ inch thickness, or a little more, at the breech—the test merely consisted in two trials of the gun; the first with ¾ oz. powder, the other with 1¾ oz., under these tests the gun neither gave way nor expanded its bore.

The fact is that, as Capt. Imlah admits, the test was absolutely valueless and proves nothing; and it is evident to me, as it must be to you, that the true test would have consisted in having two guns of equal size and of the same material, the one hardened or tempered, the other not so. Both guns should then have been tried with equal charges until the softer burst; the charge should then have been gradually increased in the tempered or harder piece and the experiment continued till that also burst, and then some idea could have been had of the relative resistances of the two metals as tempered and untempered. And if such charges of powder as required to rupture them could not be introduced, hydraulic power should have been resorted to.

In other respects, and though mechanical engineers are reticent of the truth for fear of injuring Allard, or of running the risk of saying what may not be borne out by further tests of the pretended discovery, I can find nothing to the point. One of our best machinists who was shown by Allard some bits of supposed-to-be tempered copper, says they did not stand the test he put them

to, and that possibly they may have been hardened by hammering, as copper is thus known, under repeated percussion, to become hard and tough, so he says This view seems to be also borne out by the fact set forth in the *Scientific American* of March 9th, 1895, page 155, that a 17-inch thick Harveyized armor plate at the U. S. Carnegie works, after being carbonized, was reduced by reheating and rolling to a thickness of 24 inches, subsequent to the surface carbonization process, and found to be toughened, and its internal strains minimized. But that hammering or percussion cannot be effective in all cases, or with all sizes or thicknesses of metal, my informant says, is proved by the fact that he tested a pair of copper cushions, journals, plumbet blocks, or shaft-bearers brought him by the inventor, one of which purported to be tempered, though (says he) Allard himself could not tell which. My machinist says he could see no difference between the two; that Allard then admitted it was not sufficiently tempered, and took it home with him to re-temper and returned with it next day, when the man in charge of the new test, on being asked by Allard how it stood, told him to "take it home and temper it a little more"

Quebec, March 14th, 1895

CITADEL, QUEBEC, 18th November, 1892.

REPORT UPON EXPERIMENTS CARRIED OUT WITH COPPER MODEL GUN, TEMPERED BY THE SECRET PROCESS OF F ALLARD, LEVIS, QUEBEC.

To Lieut.-Col. C. E. Montizambert, Commandant R S. Artillery, Quebec:

SIR,—The test at the Citadel, Quebec, of the tempered copper model gun was carried out on the 17th inst. Measures were taken before firing, and found to be as follows:

Length of piece	12	inches.
" of bore	11.50	"
Diameter of bore	.525	"
Greatest diameter at breech outside ..	1.025	"

Before testing, the gun was carefully gauged at two different points, one and two inches from breech end of powder chamber. The gun was charged with ¾ oz (adv.) sporting powder, and wadded with a plug of wet paper driven well home with a mallet; after firing this charge the gun was examined and gauged at the above-mentioned points, and the diameters were found to be unaltered. The next test was a very severe one, 1¾ oz. (adv.) sporting powder being used, leaving only room for a plug of paper, which, as before, was driven hard home, filling the piece to the muzzle. The charge was fired with a piece of Beckford fuse. On examination, after firing, it was found that the gun was without a flaw; expansion, if any, was imperceptible with the instruments at my disposal.

(Sd.) JAS. BARRINGTON, Sergt.-Major.

THE customs authorities have for some time past been considering the best method of insuring uniformity in the collection of duty on architects' plans imported into this country for use in the erection of buildings here, and the Controller has now determined to employ the following schedule. Each set of original drawings or single set of blue prints of same, if brought into Canada as a substitute for the original drawings, 2 per cent. of the estimated cost of the building to be erected thereon. Same, if accompanied by details, 3 per cent. of such estimated cost. Details, or blue print of same, if imported separately, 1 per cent. of the estimated cost of such detail. When additional sets of blue prints of the same set of drawings are imported, such additional sets of blue prints are to be valued for duty at $5 per set, in addition to the value of the original drawings, or first set of blue prints imported in lieu thereof, as above.

AN INVASION OF OUR RIPARIAN RIGHTS.

Editor CANADIAN ENGINEER:

SIR,—You may have noticed in the Montreal *Star* a letter of mine calling the attention of engineers and the public to the fact that Chicago is now building a drainage and maritime canal which will reduce by one-thirtieth the outflow at Niagara, shallow lake St Peter, and require further expenditure in deepening its channel. Our American cousins, seeing how unconcernedly we look on this, have become emboldened into a $100,000,000 scheme of one or more canals for business purposes from the lakes to the tide water of the Hudson.

Provision being made for the widening of the Chicago route to the Gulf of Mexico, the 600,000 cubic feet of water per minute which Congress has empowered it to rob us of, may and will within say ten or twenty years, if Chicago's population continues to increase at the same rate, be swollen to three times the quantity, or 10 per cent., equivalent to a decreased depth of 3 ft. in Lake St. Peter Now if each of the proposed canals, under the scheme just laid before the American Senate, takes another ten per cent., as according to size may be three times that, or nearly all the outpour from Erie into Ontario (18 million cubic ft. per minute), nothing will be left of the St. Lawrence but the drainage of the Ontario valley and the water poured into it by the comparatively small Ottawa, St Maurice and other tributaries How can our Dominion Parliament look on or tolerate this spoliation? Canada has the same right to her great lakes as has the United States, and if anything, even a better founded title to them, since their supply is mostly from the north or from Canadian territory, while the opposite side drains towards the South Atlantic, but even if the right of the two nations to these waters be on an equal footing, how can Congress or the United States Senate take upon itself to grant these immense franchises without the consent of our Dominion Parliament?

I am most anxious, sir, to know your views or those of the engineers of Canada in the premises, if you can only draw them out, and let the matter be discussed by our boards of trade, our legislatures, our people.

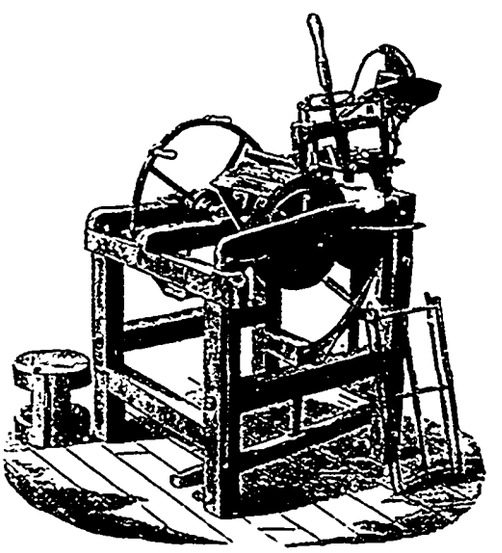
C. BAILLAIRGE,
Member Can. Soc. C.E., City Engineer, Quebec.

Quebec, March 3rd, 1895.

NEW CHEESE BOX MAKING MACHINE.

The cut shown herewith represents the Williams Patent Cheese Box Nailer and Binder. This machine fills a long felt want in the cheese industry of Canada. Cheese boxes are so bulky that they cannot be kept in stock, and what is wanted is a machine by means of which boxes can be made quickly when wanted, without the employment of a number of hands.

On this machine the hoops are fed down on to the rotary drum, and held in place by a roller which is worked by a lever, operated by the right foot The head is placed in a holder and thrown into position by one movement of the right hand (This is not shown in cut, having been added since this was made.)



The drum is revolved by a lever operated by the left hand, and the nailer by another worked by the right. This nailer far surpasses anything of its kind in use. The nails are picked up, passed down a shute, and placed in position on the up stroke of the lever, and driven home on the return. By a rotary saw attachment, designed by Mr. MacMillan, the covers and bottoms are made with great rapidity.

The machine will make any size box used in the Canadian trade, being readily adjusted, and, with one man to operate it, will turn out from 400 to 600 boxes and covers complete in a day of ten hours. The reporter who called to investigate it, and who had never made a cheese box in his life, turned one out in one minute. Though no claim is made for the manufacture of more than the above number per day, it is a fact that on one of these machines 1,000 have been turned out in a day. The machine is compact, well made, and easily shipped or transferred, and its general adoption by the cheese trade—judging by its reception in and around Belleville—is only a matter of a short time.

This machine is built by the Mac Machine Company of Belleville, Ont., for the Williams Cheese Box Machine Company, Ltd., of the same city, who hold the patent right for Canada, and who will be pleased to answer all enquiries relative to the machine.

AGAIN THE HAMILTON POWER CANAL SCHEME.

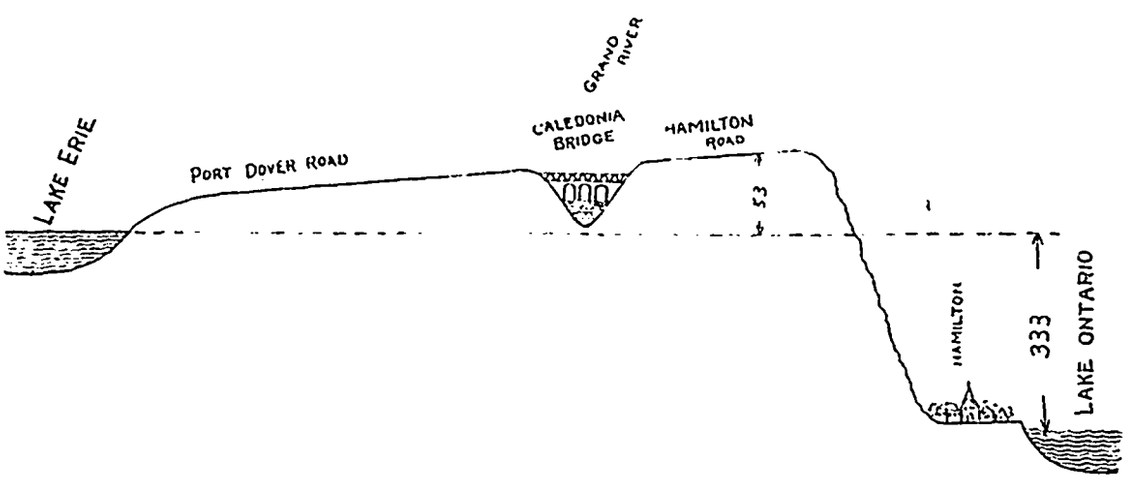
Editor CANADIAN ENGINEER:

The cubic yard has been used from time immemorial as a measure of quantity relating to work of excavating and filling, but has never been used to express the value of such work. To say that a certain work costs so much per cubic yard, conveys no idea of the magnitude nor character of the work. Nor will it serve to estimate the cost of other work of other character under other conditions. The cost of a work per cubic yard can only be known after completion And even then mistakes and extravagances must be omitted. The cost of the work under consideration can only be estimated by section, there being three sections of entirely different character, to wit.—The tail-race under the mountain, the section from the top of the mountain to Caledonia, and the section from Caledonia to Lake Erie

I firmly believe that the cut from Hamilton to the Grand River can be accomplished for the sum of $1,800 000, and that all of the work required to be done on Grand River can be accomplished for $1,000,000. I also believe the tail-race and all the work under the mountain can be accomplished for the sum of $100,000. In estimating this character of work, the cubic yard is in no sense a unit. In regard to the demand for the 100,000 horse-power which this scheme is intended to develop at Hamilton, I argue that as this power can be furnished to the consumer either in the form of heat, light, or power, cheaper and better than is done by the present method, it will be adopted And in regard to the quantity required, there can be no doubt that within a radius of 50 miles of Hamilton there is being used at present fully 100,000 horse-power in light, power and heat, all of which electricity can supply cheaper and better; for proof of which I refer to the works now being put into operation at Niagara Falls, which are to develop 100,000 horse-power, not one-tenth of which will be consumed in the vicinity, the remainder being intended for distribution to other points, the nearest of any importance being the city of Buffalo, over twenty miles distant. The condition at Hamilton will be entirely different, as at least one-third of the power will be required in the vicinity, one-third will be required along the lake shore to Toronto, and one-third in the direction of Brantford The forces of nature are depositing over the surface of the great lakes a surplus of water, equal to 230,000 cubic feet per second, one-seventieth (1/70) of which falling at Hamilton, will develop 100,000 horse power, worth as a commercial commodity $6,000,000 per year.

Annexed is profile of land between Hamilton and Grand River, which I believe is very nearly correct I estimate the average height to be not exceeding 30 feet above Lake Erie. The bed of the proposed canal from Hamilton to Grand River will average 20 feet below the surface of Lake Erie, and will contain in all not exceeding 15,000,000 cubic yards. I estimate the work in Grand River bed to require the removal of not exceeding 5,000,000 cubic yards. I have already stated that this work can be accomplished for the sum of $2,500,000. Now, if there be any information or satisfaction in reducing this sum to cost per cubic yards, it would be 12 cents per cubic yard for the cut from Grand River to Hamilton, and 20 cents per cubic yard for the work in Grand River. With well-selected appliances and honest administration this entire work should be accomplished for the sum mentioned. There is no material to buy. Every dollar will be expended for labor. This great natural force *cannot much longer* remain idle Some one will put it in harness.

In presenting my scheme for bringing water to Hamilton from Lake Erie, I stated that a channel 100 feet wide and 15 feet deep, having a descent toward Hamilton of *2 inches* to the mile, would deliver a quantity of water at Hamilton sufficient to develop 100,000 horse-power *net*. Mr. Killey says the descent towards Hamilton will require to be 2 *feet* to the mile. Now, I make the plain statement that a channel of the dimension and decline stated will deliver a given quantity of water for *developing power*, and that this quantity cannot be increased for *power purposes* by increasing the rate of descent, for the reason that in *exact ratio* as the rate of descent is increased the *net fall* is reduced, and the increase in flow due to increased rate of descent will be required to make up for reduction of *net fall*. If it is desired to pass water from Lake Erie to Hamilton for other than *power* purposes, then the greater the rate of descent the greater the quantity delivered. It is, therefore, plain that if the channel suggested is not sufficient to deliver the quantity of water required for power, the remedy will be to increase the *width*, not the depth. The one opposition to the flow of water towards the lower level is the friction of channel. If the distance between the two levels be great, the friction of channel may, as in the case of all navigable streams, consume the entire power of the fall. The Mississippi river descends 330 feet from Cairo to the Gulf, a distance of 1,100 miles, and absorbs the entire power of the fall in overcoming the friction of channel. The length of the proposed channel from Lake Erie to Hamilton is about one-thirtieth of 1,100 miles, and if we divide 30 into 330 feet fall, we have 11 feet as the proper descent of the proposed channel from Lake Erie to Hamilton. Thus we have a total fall from Lake Erie to Ontario *333 feet*, less 15 feet for depth of channel, and 11 feet descent equals 26 feet, leaving a net fall of 307 feet for developing power

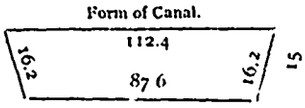


The Croton aqueduct, which supplies the city of New York, is nearly square in form, having a cross-section of fifty-three and one-third square feet, and a slope of thirty-four feet in thirty-three miles, through which the water flows with a velocity of *two hundred feet per minute* delivering one hundred and fifteen million gallons every twenty-four hours, thus proving conclusively that even in a channel one-thirtieth the size of the Lake Erie and Hamilton channel, and of inferior form, the water will acquire a velocity much greater than required, *with one-half the slope* claimed as necessary by Mr. Killey.

As requested by Mr. Killey, I herewith furnish mathematical proof that the channel described will pass the quantity of water stated I have carefully applied the formula suggested by Mr. Killey to the form, dimensions and conditions of the channel under consideration, while he has with equal care applied the formula to a channel of other form, dimension, and conditions. Hence the discrepancy in result. I may here state that the formula relied upon, being made up from observation of the flow of water through irrigating and draining canals, does not apply to channels for passing water for power. In the former case excessive slope is required to set the water in motion during sudden and heavy rainfall, while in the latter case the conditions once established continue indefinitely.

Accepting formula $C = \dfrac{a + \frac{l}{n} + \frac{m}{s}}{1 + \frac{n\left(a + \frac{m}{s}\right)}{\sqrt{r}}}$

Form of Canal.



$a = 41\ 65$, $l = 1.811$, w 0.017 for rubble
$m = 0.00281$, $s = 0.2$ in 5000 0000.4
Area of canal 1500'
Depth " 15'
Perimeter = 120'
Mean radius 12.50

Now substituting these values in the above formula, it becomes

$$c = \frac{41.65 + \frac{1.811}{0.017} + \frac{0.00281}{0.00004}}{1 + \frac{0\ 017\ (41.65 + \frac{0.00281}{0.00004})}{\sqrt{12.50}}}$$

The 2nd term of numerator = 106.53
" 3rd " " " = 70.25
" 2nd " " denominator = 0 538

and summing the terms

$$c + \frac{218.43}{1.538} = 142.02$$

and velocity $= c\sqrt{12.50 \times 0.00004}$
This radical = 0 0223 and
Velocity = 142 × 0.223 = 3'.17 per second

$$\frac{\text{Vel.} \times \text{area} \times 60 \times 62.4 \times 300}{33.000} \text{ H P}$$

$$\frac{3.17 \times 1500 \times 60 \times 62.4 \times 300}{33.000} = (161843)$$

Now 161843 less 33⅓ per cent. leaves net (107895) horse power.

Yours respectfully,

WM GOLDING.

New Orleans, La., March 25th, 1895.

THE MONTICELLO BOILER EXPLOSION CASE.

At Orangeville, March 22, the case of Darragh v. Bowers, Essery and Frank was tried before his Honor Judge Boyd and a jury, and resulted in a verdict for the defendants with costs. This action was brought about by Mrs. Darragh to recover damages for the loss of her husband, Alex. Darragh, who was killed by the explosion of a boiler belonging to the defendants at Monticello, near Orangeville, in November last. A large number of witnesses were examined, and parts of the boiler, including the safety valve, were put in as evidence by the plaintiff. A. E. Edkins, inspector for the Boiler Inspection 'and Insurance Co., was subpœnaed by the plaintiff to give evidence on her behalf, as he had examined the remains of the boiler after the explosion, for the Attorney-General's department, and had made a report as to the cause, etc.

It came out in the evidence that the man McQuarrie, who was hired as fireman by the defendant Bowers, was supposed to be a competent person to have charge of a boiler, he having been accustomed to that kind of work for a number of years, and as the judge held that there was no evidence to prove that the death of said Alex Darragh was caused through any neglect on the part of the defendants, he refused to allow the case to go to the jury and dismissed the action with costs.

THE LICENSING BILL.

On the evening of the 14th a deputation of the Can. Ass'n of Stationery Engineers waited on the Ontario Cabinet Ministers, and were cordially received by Sir Oliver Mowat, Hon. Mr. Hardy, Hon. Mr Gibson and Hon. Mr. Bronson. After Bros. Edkins, Devlin and Robertson had spoken, O. B. St. John, president of the Marine Engineers, also spoke very forcibly, showing how well the license and inspection law had worked since its inception. During the time taken by the speakers, the members of the Cabinet asked many questions and expressed themselves to the effect that some measure should be passed, the Premier asking for a draught of the proposed bill as soon as possible. Mr. Crawford, of West Toronto, enters the bill. The delegation consisted of members from Ottawa, Kingston, Hamilton, London, Brantford, Peterboro, and many of the leading local men, in all about thirty. All left feeling that the matter of licensing engineers was gaining ground.

THE Dominion Government Department of Trade and Commerce has received word from Jamaica that the prospects for extending Canadian trade there are good, and reciprocal trade arrangements are proposed.

THE MANUFACTURE OF STEEL CLAD BATHS.

To George Booth, founder of the late firm of "Booth & Son," and at present sole proprietor of the "Booth Copper Co." of Toronto, is due the credit for having established the first factory for the manufacture of bath tubs in the Dominion.

About the year 1875, Booth & Son installed a plant for the production of wooden bath tubs with copper linings. With the advance of sanitary science these goods became obsolete, and becoming impressed with the need of a "strictly sanitary" article, at a popular price, Mr. Booth conceived the idea, and applied for patents on what is now widely known as the Steel-Clad Bath. The patents were subsequently issued in Canada, England, United States, and Australia.

As an outcome of this mark of Canadian enterprise and genius, we can now chronicle the existence of no less than four corporations engaged in the sole manufacture of these goods, viz.: The Toronto Steel-Clad Bath and Metal Co., Ltd.; the Steel Bath Mfg. Co., of Detroit; the Steel-Clad Bath Co., of New York; and the Sanitary Bath Co., of London, England.

The total aggregated capital of these companies amounts to about one-fourth of a million dollars, and we are informed that a most prosperous condition of affairs is reported from each, which fact is worthy of more than passing comment, when we stop to consider that all of this industry has sprung from Canadian sources.

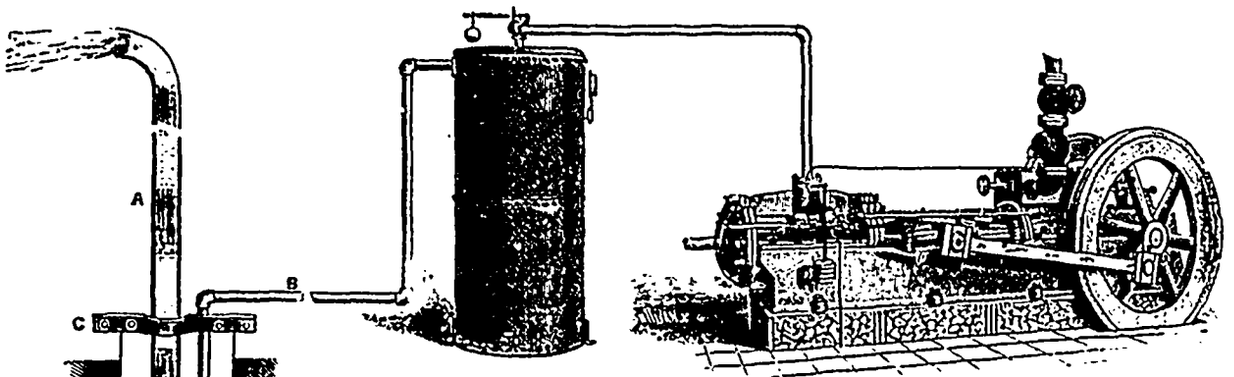
As to the goods themselves any notice here would be almost superfluous, as they are widely and favorably known. The head office of the company is at 123 Queen st. east, Toronto, George Booth being president, Jos. Wright vice-president, and A. G. Booth sec.-treasurer. Distributed throughout the Dominion are agencies and warehouses, that in Montreal being in charge of H. McLaren & Co., 706 Craig st.

GEORGE BOOTH.

In the Garden of England the subject of this sketch was born, on Oct. 2nd, 1838. His father, the late H. G. Booth, and also his grandfather, both followed the occupation of coppersmiths, in the town of Cranbrook, County of Kent.

On the 7th of May, 1844, the ship "Hendrick Hudson" sailed from London for New York, having on board the late H. G. Booth and family, consisting of his wife, two sons and a daughter, Geo. Booth being the younger son. After some two years spent in Pittsburg and Cincinnati, the family came to Canada. In those days locomotion was somewhat crude, canals being used largely for the transportation of travellers. Now-a-days railroads tunnel under the mountains, but Mr. Booth tells us that in the "forties" he travelled *over* the Alleghanies in a canal boat. After several changes of one kind and another the Booths finally settled in Toronto permanently. The firm of H. G. Booth & Son was formed, and later on succeeded by the firm of Booth & Son, George Booth being sole owner.

Under the firm name of The Booth Copper Co., Mr. Booth now carries on the same business: he is also president of the Toronto Steel Clad Bath Co., and the Steel Bath Mfg. Co., Detroit, and has for many years served as treasurer of the Canadian Manufacturers' Association.



PUMPING WATER BY COMPRESSED AIR.

Those interested in mining and hydraulics will be glad to have some account of the Pohlé system of raising water from non-flowing wells, mines, etc., which has been introduced into Canada by the Ingersoll-Sergeant Drill Company of Montreal

The following description is given by the makers.—The pump proper consists of only two plain open-ended pipes, the larger one with an enlarged end-piece constituting the discharge pipe, and the smaller one let into the enlarged end-piece of the discharge pipe constitutes the air inlet pipe, through which the compressed air is conveyed to the enlarged end-piece to the under side of the water to be raised. No valves, buckets, plungers, rods, or other moving parts are used within the pipes or well.

In pumping, compressed air is forced through the air pipe into the enlarged end at the bottom of the water pipe, thence by the inherent expansive force of the compressed air, layers or pistons of air are formed in the water pipe, which lift and discharge the water layers through the upper end of the water discharge pipe At the beginning of the operation, the water surface outside of the pipe and the water surface inside of the pipe are at the same level, hence the vertical pressures per square inch are equal at the submerged end of the pipe, outside and inside As air is forced into the lower end of the water pipe, it forms alternate layers with the water, so that the pressure per square inch of the column thus made up of air and water, as it rises inside of the water pipe, is less than the pressure of water per square inch outside of the pipe Owing to this difference of pressure, the water flows continually from the outside to within the water pipe by gravity force, and its ascent through the pipe is free from shock, jar, or noise of any kind.

These air sections, or strata of compressed air, form watertight bodies, which, in their ascent in the act of pumping, permit no "slipping" or back flow of water. As each air stratum progresses upwards to the spout, it expands on its way in proportion as the overlying weight of water is diminished by its discharge, so that the air section, which may have been, say, 50 lbs. per square inch at first, will be only 1 74 lbs. when it underlies a water layer of four feet in length at the spout, until finally this air section, when it lifts up and throws out this four feet of water, is of the same tension as the normal atmosphere; thus proving that the whole of its energy was used in work, and that this pump is a perfect expansion engine

As the weight of the water outside of the discharge pipe (the head) is one-third greater per square inch than the aggregate water sections within the pipe when in operation, it follows that the energy due to this one-third greater weight is utilized in overcoming the resistance of entry into the pipe, and all the friction within it.

The Pohlé "air lift" pump gives ninety per cent. of efficiency from the air receiver in water pipes of large diameter, and as a rule, above eighty per cent. It retains this efficiency without repairs, or until the pipes rust through, whereas ordinary bucket and plunger pumps gradually lose efficiency from the first stroke they make, and lose it rapidly if the water contains sand or is acid in character It has been estimated by competent experts, that under favorable conditions and large diameters of water and air pipes, 1,000,000 gallons of water can be raised 100 feet high with one and a half tons of good coal.

The air reservoirs are all strongly made of homogeneous steel, tested and guaranteed at working pressures of 110 pounds; they are provided with the proper openings for inlet and outlet pipes, manhole and head, drain cocks, pressure gauge and safety valve.

As the pump has no valves, no standing water remains in the pump column after the operation of pumping; it recedes into the well, and there is none left to freeze in cold weather. The capacity of the pump is unlimited, and with the proper proportions of air to the water, will work efficiently in pipes several feet in diameter. Estimates have been made which indicate that a thirty-inch pipe will deliver 16,660 gallons per minute, equal to 1,000,000 gallons per hour.

As sand, silt, gravel, and bowlders in water form no obstacles to interfere with the action of the pump, its adaptability for dredging is suggested as well as its utility for pumping sewage. Experience has proved that by the use of this constant upward flow of water, artesian wells have been freed from their accumulated sedimentary deposits, as well as that lodged in the fissures and crevices of their wall rock, and have been thus made to yield greater quantities of water than they ever did before. For chemical uses, and for the liquids of the arts, there is no superior method than the "Air Lift" It is used successfully for raising sulphuric acid of high specific gravities, and is well adapted for ore leaching works, vinegar works, sugar refineries, dye works, paper pulp works, etc.

As an irrigating pump for raising subterranean water in the arid regions of the west, its field of usefulness is very promising, for with one air compressing plant at a central station, a number of wells, widely separated from each other, may be simultaneously pumped by branches of air-conveying pipes, taken from a main air pipe from the air compressor; for compressed air may be conveyed for miles without material loss of power.

It often happens that a single well does not yield the quantity of water desired, but that a number of wells would give the satisfactory result. By the old-fashioned deep well pump, each well would require a separate "steam head," separate sets of rods, and the other pharaphernalia, which, with the condensation of the steam, when conveyed to the several steam heads, would be very costly in the first outlay, and very wasteful of power in its maintenance, to say nothing of loss of time in repairs. By the Pohlé process, but one air compressing plant is required, and this may be placed in the engine room or the boiler house, directly under the eyes of the engineer, from whence the air may be conveyed to the several wells, all of which may be pumped simultaneously and economically. Further details of the construction and operation of this pump may be obtained by writing to the Ingersoll-Sergeant Drill Co., 164 St. James street, Montreal.

ASSOCIATION OF ONTARIO LAND SURVEYORS—ANNUAL MEETING, 1895.

The association held its tenth annual meeting at the Canadian Institute, Toronto, on 26th, 27th and 28th February, 1895, the president, M. J. Butler, presiding.

In addition to the usual routine business, thirteen papers, by members of the association, were read.

Paper by D. D. James, Toronto, on "Indexing Office Information," contained a description of a useful method of classifying in atlas form the notes, plans, etc., relating to the several districts into which the practitioner's territory may, for convenience of reference, be divided.

A paper by C C. Fairchild, Brantford, gave a graphic description of "Flood Prevention Work at Brantford," and was accompanied by a diagram showing the positions of the various works.

J. F. Whitson, Toronto, read a paper on the "Rainy River District," setting forth in chronological order the explorations and discoveries which have been made in that region from the early days of the Hudson Bay and North-West fur-trading companies up to the present, with the vast resources, mineral and agricultural, of the district concisely represented.

"The Eightieth Meridian," from its intersection with the north shore of Lake Erie to the most northerly point known, was dealt with in a lengthy paper, full of interest, by Willis Chipman, of Toronto. Mr. Chipman divided this line, for the purposes of discussion, into four main sections, each of which was further subdivided, and under the several heads gave a large amount of information as to the climate, products, etc., of the country traversed, and succeeded in arousing the interest of his audience in the possibilities of further discoveries which may be made in the far north.

W. A. Browne, Toronto, read an interesting paper on "The Dawson Route," filling in many blanks in the history of the survey of that great highway and giving reminiscences of the famous Red River Expedition of 1869.

An inexpensive, but effective "Drain Gradient Instrument," contrived by himself, was described in a paper by A. R. Davis, Napanee, who illustrated its working by a model. The advantages which farmers may derive from the use of this contrivance are readily understood by those who know of the amount of labor and expense wasted in improperly laid farm drains throughout the country.

A paper by Otto J Klotz, of the International Boundary Commission, Ottawa, contained a comparison of the various styles of "Aneroids," with a compilation of the results from their use in Alaskan surveys and elsewhere.

H. K. Wicksteed's paper on "Triangulation Work on Topographical Surveys" described a particular case in which, by the adoption of this method, he had been enabled to reduce the labor and arrive at better results than could have been possible in the ordinary methods of traversing. A diagram of the work will be found of service to surveyors unaccustomed to that class of work.

"Co-efficient of Refraction" was treated of in a paper by Otto J. Klotz, Ottawa, and included the results of careful observations made in photo-topographical surveying in Alaska.

A paper on "The Cradle Theodolite," by J. M. O. Cromwell, Perth, contained a description of that instrument, with comparisons of its merits with those of other instruments past and present.

The subject of "Highway Bridges" was the text of a paper by P S Gibson, Willowdale, and embraced descriptions of bridges in town and country, setting forth more particularly the advantages of a system of small timbers properly joined as compared with the more cumbrous, heavy timber style, in point of durability and expense.

H. J. Bowman, Berlin, contributed an interesting and useful paper on "Good Streets," which contained information upon a subdivision of the much discussed topic of "Good Roads."

A paper on "Mining," by J. D. Evans, Trenton, was read as sequel to his former paper on "Mining in the Sudbury District," already well known to readers of the annual report.

Among the visitors during the meeting were W. F. King, D.T.S., Dominion astronomer, Arthur Harvey, president of the Canadian Institute; J. McDougall, engineer for York County, and others.

The annual dinner, which took place on the evening of the 27th, met with such general approval that it may in future be included in the routine business of the yearly programme.

Through the courtesy of the Alumni Society, the members of the association, with their friends, were treated to a most enjoyable evening at the School of Practical Science, on Thursday evening, 28th, the programme combining interesting stereopticon views, with instructive tests of various materials, in addition to the attractions of the mineral collection room.

The meeting of '95 was considered by all in attendance as the most successful yet held.

MAURICE GAVILLER, PRES. ELECT ASSOCN. OF ONT. LAND SURVEYORS.

MAURICE GAVILLER, president elect of the Association of Ontario Land Surveyors, is a graduate of McGill College, Montreal, having passed as a Bachelor of Applied Science in 1863. After practising as a civil engineer for a time, he qualified as a Provincial land surveyor in 1866. Mr. Gaviller is now a member of the board of examiners of the association. He has not only had a varied experience in his profession in Canada, but has travelled extensively throughout the world. He is now engaged in practice of his profession, with offices in Collingwood and Barrie, Ont. Mr. Gaviller is personally held in high esteem among the members of his profession, and at few elections in the history of the association has the choice of president met with a better reception.

WILLIS CHIPMAN, VICE-PRES. ASSOCN. OF ONT. LAND SURVEYORS.

WILLIS CHIPMAN, C.E., was born near Brockville in 1855, his ancestors being among the pioneers of settlement in Eastern Ontario His great grandfather settled a few miles north of Brockville in 1795 Mr. Chipman, who is an only son of an only son, graduated at McGill College in 1876 as a Bachelor of Applied Science, taking first-class honors in Natural Science. After graduating he was first employed on Toronto waterworks in 1876, and after a short time in Toronto he moved to Napanee, where he was appointed teacher of mathematics in the Napanee High School. He held this position for three years and then went to Montreal, where, in 1880, he was appointed to the staff of the Montreal Harbor Commission. In the latter part of that year, and the following year, he served in Manitoba on the surveys, and passed as land surveyor in the latter year. In December, 1881, he opened an office in Brockville as civil engineer and land surveyor. In 1887 he was appointed town engineer, a position he held up till 1892 While holding this position he also planned the construction of the Goderich waterworks in 1888, and the Barrie waterworks in 1889, which latter works were completed in 1891. From 1882 to 1888 he served on several surveying expeditions in Algoma for the Ontario Government. Since opening his office in Toronto, in 1889, Mr. Chipman has designed or superintended waterworks, sewage works, or hydraulic improvement works for a number of towns in Ontario besides those just mentioned, among others those in Galt, Gananoque, Pembroke,

Brockville, Cornwall, Brantford, Toronto Junction and London. He has also furnished many special reports on municipal works in other Canadian cities. Though one of the youngest members of the profession at the time of the formation of the Ontario Association of Land Surveyors, the remarkable progress of which is outlined in this issue, Mr. Chipman, as mentioned elsewhere, may be called its founder

A. J VAN NOSTRAND, SEC.-TREAS. ASSOCN. OF ONT. LAND SURVEYORS

Arthur J. Van Nostrand, the present secretary-treasurer of the Association of Ontario Land Surveyors, was born near Aurora, Ontario, Oct. 14th, 1861. During 1877-8, and part of '79, he attended the Newmarket High School; passed the "preliminary" examination before the Board of Examiners for P.L S. in July, 1879, and was articled to P. S. Gibson in September of that year. In 1881, under transfer of articles, he served for six months as assistant to Major A C. Webb, D.L.S., of Brighton, who was then engaged upon "Standard Meridians and Parallels" surveys in the Northwest Territories. Returning to Ontario he completed the term with Mr. Gibson, and passed as P.L.S. in Oct., in 1882, and as D.L.S. in November of that year. The following winter was spent by him in the land survey and plans of the Murray canal under Major Webb, and the seasons of 1883 and 1884 on Dominion lands surveys in the Northwest with J. Doupe, D.L.S., of Winnipeg. In 1885 a partnership in land surveying was entered into with T. B. Speight, of Toronto, where the firm of Speight & Van Nostrand still continues to practise. Upon the retirement of Mr. Willis Chipman as secretary-treasurer of the Association of Provincial Land Surveyors for Ontario in 1890, Mr. Van Nostrand was elected to that office, which he still occupies to the eminent satisfaction of that organization.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

An ordinary meeting of the society took place in Montreal on Thursday, 14th ult., President Thos. Monro in the chair The secretary stated that Mr. Grey's paper on "Commerce of the Great Lakes," which had been returned for amendments, had been returned with these marked.

THE CEMENT QUESTION.

Discussion took place on Mr Cecil B. Smith's paper on "Cement Testing," a report of which will appear in a later issue.

Another meeting of the society took place on the 28th ult, Mr. Kennedy in the chair.

Mr. Charles Baillairgé wrote, drawing attention to the code of ethics as drawn up by the Boston Association of Architects. His letter was referred to the Committee on Professional Ethics.

A paper by G. E. Robertson was read on "An Application of the Stoney Patent Sluice to River Improvements."

There was no discussion. The next business was the discussion on Prof. Bovey's paper on the "Strength of Timber."

Mr. James E Howard (by correspondence) stated that it was more difficult to gain a true idea of the strength of timber than it was in the case of steel or iron. Timber, unlike iron or steel, could be brought to very near its breaking point without being materially injured, whereas metal would show the marks of overstrain very clearly, and, under a subsequent strain, would very likely break altogether. Whether it was advisable so to strain timber, however, was another question. The hydrometric condition of wood, too, exercised a disturbing influence, and difficulty was often experienced in calculating accurately upon the exact strain at any given point.

Mr. Baillairgé wrote a few notes on the ball jet fire nozzle, the problem presented by which he stated was unsolved by the inventor of the appliance himself. When the jet was turned on a vacuum was formed behind the ball, he supposed, and this prevented the latter from going against the guard. The water issued in the form of a spray

Mr. Kennedy did not see how it could be stated so definitely that there was a vacuum created behind the ball. It needed further proof, he thought.

Mr. Sproule could not understand how a vacuum could be created in front of the jet of water, in spite of its issuing with a pressure of 100 lbs. per square inch, for example. It was resolved that Mr. Baillairgé should be requested to give full description of the apparatus, with drawings to scale, and a full explanation of the phenomena presented.

POINTS ABOUT PUMPS AND WATER.

A CUBIC foot of water contains 7.48 gallons, or 1,728 cubic inches, and weighs 62½ pounds.

A GALLON of water contains 231 inches, and weighs 8½ pounds (U.S. standard).

THE friction of water in pipes is as the square of the velocity

THE capacity of pipes is as the square of their diameters, thus doubling the diameter of a pipe increases its capacity four times.

THE height of a column of fresh water, equal to a pressure of one pound per square inch, is 2.32 feet. (In usual computations this is taken at 2 feet, thus allowing for ordinary friction.)

To find the area of a piston, square the diameter and multiply by .7854.

EACH nominal horse power of boilers requires 1 cubic foot of water power per hour.

To compute the horse power necessary to elevate water to a given height, multiply the total weight of column of water in pounds, by the velocity per minute in feet, and divide the product by 33,000. (An allowance of 25 per cent. should be added for friction, etc.)

To compute the capacity of pumping engines, multiply the area of the water piston (in inches) by the distance it travels (in inches) in a given time. The product divided by 231 gives number of gallons in time named.

To find the capacity of a cylinder in gallons. Multiplying the area in inches by the length of stroke in inches will give the total number of cubic inches; divide this amount by 231 (which is the cubical contents of a gallon in inches) and product is the capacity in gallons.

ORDINARY speed to run pumps is 100 feet of piston travel per minute.

To find quantity of water elevated in one minute running at 100 feet of piston travel per minute. Square the diameter of water cylinder in inches and multiply by 4 Example: Capacity of a five-inch cylinder is desired. The square of the diameter (5 inches) is 24, which multiplied by 4, gives 100, which is gallons per minute (approximately).

To find the diameter of a pump cylinder to move a given quantity of water per minute (100 feet of piston travel being the speed), divide the number of gallons by 4, then extract the square root, and the product will be the diameter in inches.

To find the velocity in feet per minute necessary to discharge a given volume of water in a given time, multiply the number of cubic feet of water by 144, and divide the product by the area of the pipe in inches.

To find the area of a required pipe, the volume and velocity of water being given, multiply the number of cubic feet of water by 134, and divide the product by the velocity in feet per minute. The area being found, it is easy to get the diameter of pipe necessary.

THE area of a steam piston, multiplied by the steam pressure, gives the total amount of pressure exerted. The area of the water piston, multiplied by the pressure of water per square inch, gives the resistance. A margin must be made between the power and the resistance to move the piston at the required speed.

THE area of the steam end of the pump multiplied by the steam pressure gives the total amount of pressure.

THE area of the water piston or plunger multiplied by the pressure of water per square inch, gives the resistance, and in making computations regarding pumps a margin must be made between the power and the resistance in order that the pistons may have the required velocity.

PUMPS, in order to be effective, should have, at all times, a full

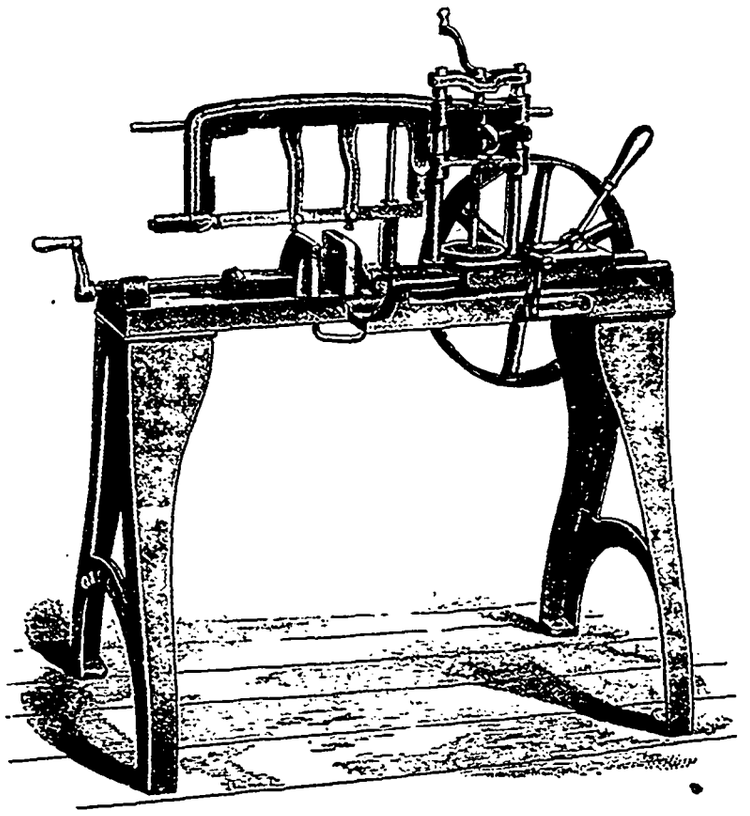
supply of water, and the pipes should have as small a number of bends and valves as possible, as the element of friction is greatly increased thereby.

To obviate any possibility of a break down during the cold weather, all pumps ought to be suitably drained; bad and otherwise dangerous breaks have occurred to pumps which have been allowed to stand with the cylinder full of water in places exposed to freezing temperatures.

PUMPING hot water is not to be advised unless the supply is on a level with or slightly above the pump; owing to the great expansibility of gases when at elevated temperatures, the vapors arise and fill the spaces behind the piston, and consequently no liquids can enter.

THE "Q & C" SHOP SAW WITH AUTOMATIC FEED.

The accompanying cut shows a new machine-shop tool that will be found of great value, and a time saver for cutting all kinds of metal, iron, steel, brass and castings, including tool steel. Capacity, five inches and less.



The "Q & C" Shop Saw is a great improvement over the gravity feed, or Hack Saw; has positive feed, entirely automatic, and speed can be instantly changed to accommodate all classes of work. The common Hack Saws depend entirely upon gravity to feed the saw through the work, and, as the weight of saw frame cannot be increased, the cutting speed diminishes as the size of work increases, whereas with the "Q & C" Shop Saw, having automatic screw feed, the same cutting speed is maintained throughout. The old style machines drag the blades backward on the return stroke with nearly, if not quite, as much pressure as when cutting, destroying the keenness of the edge as well as the blade itself in a short while The "Q & C" Shop Saw clears the metal on return stroke, effecting an actual saving of 50 per cent. of wear; a single blade lasting from three days to two weeks. The special saw blades furnished are claimed to be superior to all others.

The "Q & C" Shop Saw was specially designed to overcome the known weakness of the old style machines, which are very slow and very expensive to keep supplied with saw blades; one of these special blades will outwear several dozen of the old style.

The machines are supplied with movable vise, allowing use of entire blade, also double adjustable guards to hold the blade firmly, ensuring true work.

An evidence of the time saved by using this saw will be seen by the following comparison :—

OLD STYLE.

Size of Work.	
1 inch round steel	9 minutes.
2 " " "	36 "
3 " " "	2 hours.
4 " " "	3 "

THE "Q & C."

Size of Work.	
1 inch round steel	3 minutes.
2 " " "	9 "
3 " " "	27 "
4 " " "	45 "

The above test was actually made, using a *new* saw blade on each cut made on the old style machine, and a *single* blade for the four tests on the "Q & C" Shop Saw.

Darling Brothers, "Reliance Works," Montreal, are manufacturers of this machine.

CANADIAN COAL COMPANIES.

Our enterprising contemporary, the *Coal Trade Journal*, of New York, recently had what it called a Canadian number, from which the following list of the coal companies of Canada is taken :

Acadia Coal Co., Ltd.—Capital issued, $3,846,100. Directors - J. W. Clendenin, president, No. 1 Broadway, New York; Bryce J. Allan, H. Montagu Allan, H. A. Allan, W. H. Davies, Thomas H. Hubbard, Johnston Livingston, J. Pierpoint Morgan, jr, Edwards S. Sanford, Wm. Strapp, George W. Ward, Main office, Stellarton, N.S. Henry S. Poole, general manager; J. G. Rutherford, assistant general manager. Mines are: Acadia colliery, at Westville, three miles from Stellarton; Albion colliery, at Stellarton, and Vale colliery, six miles east of New Glasgow. Total 1893 output, 273,206 tons; coke, 1893, 24,266 tons; total number of employés, 1,050.

Alberta Railway and Coal Co.—Capital stock, $7 250,000. Directors—Sir R. W. Cameron, New York, T. Davidson, E. T. Galt, Wm. Burdett-Couts, T. E. Collins Edward Crabb, A. W. Stirling, Wm. M. Ramsay, Peter Redpath. Head office, 37 Old Jewry, London, E.C. E. T. Galt, managing director; W. D. Barclay, general superintendent. Mines at Lethbridge, Alta. Total 1893 output, 150,000 tons; 1,000 men employed. This company sells coal at 143 points in the Canadian North-west, the most distant being 830 miles from Lethbridge.

Anthracite and Bituminous Coal Co., Ltd.—Capital stock, $250,000. Directors—B. E. Chaffey, Winnipeg, Man., president; W. Hamilton Merritt, S. H. Fleming, F. A. Fleming, G. F. Hardman. Main office, 15 Toronto street, Toronto, Ont. Mines, known as Bow River mines, are on the main line of the C. P. R., about three miles west of Cochrane Station.

Boston and Nova Scotia Coal Co., Ltd.—Capital issued, $5,000,000. Directors—Hon. Jno. W. Candler, president, Boston; John Russel Gladding, Hon. David S. Baket, jr., John McKeen, John C. Cobb, W. J. Fraser, A. C. Ross, R. P. Fraser. Main office, 66 State street, Boston, Mass. Mines are situated 14 miles from Mabou and 35 from Orangedale Station, on the Intercolonial Railway.

British Columbia Coal, Petroleum and Mineral Co., Ltd.—Authorized capital, $4,000,000. Directors—Joseph D. Pemberton, Victoria; Lt.-Col. E.G. Prior, M.P.; Wm. Fernie. Formed to purchase from the Crow's Nest Coal & Mineral Co., Ltd., all their real and personal property for the sum of $4,000,000.

Broad Cove Coal Co., Ltd.—Authorized capital, $3,000,000. Directors—W. Penn Hussey, W. H. Munroe, John Y. Payzant, Wm. H. Wiswell, Hon. J. M. Raymond. Formed to mine, quarry and prepare for sale by any process, and to carry, sell, and deal in coal, ironstone, copper and copper ores, manganese and other minerals, etc., and generally to carry on the trades of mine and coal owners, etc., in Nova Scotia. Not at present in operation.

Cambrian Coal Co., Ltd.—Authorized capital, $83,100. Directors—R. S. B. O'Brien, Edward Quennell, Thos. D. Jones. Head office, Nanaimo, B.C. The property owned by this company contains 831 acres of mineral land, situate in the Cedar district, Vancouver Island. This property is for sale.

Canada Coals & Railway Co.—Capital stock, $750,000. Direc-

tors—Samuel Finley, president, Montreal; A. A. Gault, Edward Hanson, S H Ewing, R. W. Smith, R. L. Gault, E. W. Wilson. Head office, 157 St. James street, Montreal. The company controls an area of 15 square miles, upon which is situated the Joggins colliery at Joggins Mines, in the County of Cumberland, Province of Nova Scotia. Collieries 11 miles from Maccan station, on the main line of the Intercolonial Railway. Total output, 1893, 91,250 tons

Canada North-West Coal & Lumber Syndicate, Ltd.—Authorized capital, $351,000. Directors—Sir George Baden Powell, M.P.; E Bainridge, Viscount Grimstone, M P., the Earl of Norbury, T. B. H. Cochrane. Head office, 6 Clement's Lane, London. T. B. H Cochrane, managing director Company owns 1,280 acres of coal land at Canmore, and 2,880 at Mitford, in the Province of Alberta; 55 employés. Output in 1890, 10,000 tons. This coal is chiefly used on locomotives of the C.P.R.

Canadian Anthracite Coal Co, Ltd —Capital stock $1,000,000. Officers—Hon J. G Thorpe, Cambridge, Mass., president, O. H. Ingram, W. K. Coffin, Archibald Stewart, L. Crannell. Head office, the Molson's Bank Chambers, 14 Metcalf street, Ottawa, Ont. The company owns about 7,000 acres in the District of Alberta, N.W. Territories. In 1891 the colliery and lands were leased to the H M. McNeill Co

Cape Breton Colliery.—Owners—J. T. Burchell, J. E. Burchell. It is situated at New Campbellton, at the mouth of the Big Brass d'Or Lake, Cape Breton, Nova Scotia; 100 employés. Output in 1893 about 2,400 tons.

Consolidated Scotia Coal Co., Ltd. Authorized capital $500,000. Directors—Jno. T. Smith, Edward Curran, Thompson J. Copp, C. W. Hewson, Charles Smith. Head office, Amherst, N S. Formed to operate and purchase coal and other mines in the Province of Nova Scotia.

Crowfoot Coal Co.—Nominal capital stock, $125,000. Directors—W. A Allan, Herbert Archibald Arthur F. Eden. Head office, 180 Owen street, Winnipeg. Formed to acquire by purchase, lease, surrender, gift, exchange, or otherwise, a tract or tracts of coal lands assumed or reported to cover and contain deposits of coal or like deposits, in Manitoba, British Columbia, or the N.W. Territories of Canada

Crow's Nest Coal and Mineral Co., Ltd.—Authorized capital, $2,000,000 Directors—Lt. Col. James Baker, president; Jose D. Pemberton, C E; Wm. Fernie, Peter C. Fernie, Edward Bray. Head office, 45 Court street, Victoria, B.C. Company owns 11,169 acres of coal lands situate near Martin Creek, in the East Kootenay district, Province of British Columbia; employés, 20

Cumberland Ry & Coal Co.—Authorized capital, $2,000,000. Directors—Robert Cowans, president; Hon G. A. Drummond, vice-president; David Morrice, H. R. Drummond; J. R. Cowans, general manager; W. J. Morrice, E. McDougall. Head office, Imperial Building, Place d'Armes, Montreal E. Laflamme, assistant to general manager; C Hargraves, assistant manager; R. H. Cooper, cashier. Mine office, Spring Hill, N.S. Formed to work, acquire and develop coal land of which some 70 square miles are held under lease from the Government of Nova Scotia; 734 employés. Total output, 1893, 391,139 tons.

Dominion Coal Co., Ltd.—Authorized capital, $18,000,000. Directors—Henry M Whitney, Boston; Sir Donald A. Smith, Henry F. Dimock, Hugh McLennan, F. S. Pearson, W. C. Van Horne, Robert Winsor, W. B. Ross, Alfred Winsor. General offices, 95 Milk street, Boston, Mass Has acquired an area of 70 square miles of coal lands in Cape Breton, upon which are the following collieries. Caledonia, International, Gardiner, Glace Bay, Old Bridgeport, Reserve, Gowrie, Victoria, Ontario, Sword, Meagher and other coal areas, steamers, lines of railway, etc. Total amount of coal mined to December 31, 1893, 834,019 tons. Disposed of as follows. Quebec, 499,873. Nova Scotia, 109,822; New Brunswick, 35,391, Newfoundland, 30,054, balance scattering.

Dominion Coal, Coke & Transportation Co.—Authorized capital, $500,000. Directors—A. G. Yates, A Jardine, D. E. Adams, Major Walsh, Louis Walsh. Head office, Winnipeg. Company owns 2,000 acres of coal lands in the Province of Assiniboia. Mines at town of Estevan; 85 persons employed. No report for 1893 received.

East Wellington Coal Co.—Authorized capital, $1,500,000. Directors—J. Lawrence Pool, president, San Francisco; J. Eastland, Col. Mendall, R. D. Chandler, Wm. Whitney. Head office, 507-509 East street, San Francisco, Cal. The company owns property containing 650 acres, upon which is the East Wellington colliery, in the Province of British Columbia; 140 employees; 1893 output, 28,000 tons

General Mining Association, Ltd., of London, Eng.—Capital stock, $1,098,760. Directors—J. D. Hill, chairman; Sir Charles Tupper, Bart.; W. S. Cunard, Col. W. C. Western. Head office, Blomfield House, London Wall, London, E.C. This company owns and operates certain coal lands on the Island of Cape Breton, Nova Scotia. Mines at Sidney and Victoria. Output for 1893, 278,740 tons; 959 employees. R. H. Brown, general manager, Sydney mines; Cunard & Co., agents, Halifax.

Grand Lake Coal Co.—Capital stock, $200,000. Directors—Jno. P. Isly, president, Philadelphia; Louis G. de Bertram, Thos. W. Williamson. Head office, Chipman, N.B. This company owns 5,000 acres of coal lands in the Newcastle district, and in addition 500 acres at Chipman, Queen's county, in the Province of New Brunswick. Not at present in operation.

Intercolonial Coal Mining Co, Ltd.—Authorized capital, $500,000. Directors—Jas. P. Cleghorn, president; Henry A. Budden, Hartland S. Macdougall, W. M. Ramsay, A. W. Hooper, G. Goff Penny, Alexander Gunn, Thos. Wilson, R. MacD. Paterson. Head office, 199 Commissioner street, Montreal. W. J. Nelson, secretary. This company's property contains 2¾ square miles of coal areas, upon which is the Drummond colliery, at Westville, in the county of Pictou, N S. Total output 1893, 222,385 tons; number of employés, 454

Kamloops Coal Co., Ltd.—Authorized capital, $200,000. Directors—J. F. Smith, M. Gaglietto, Jean B. Lateremouille. Head office, Kamloops, B.C. This company owns 2,275 acres of coal lands on Newhykwalston Creek, at a point about 50 miles north from the town of Kamloops. Mines are not in operation.

Mabou Coal and Gypsum Co., Ltd.—Authorized capital, $100,000. Directors—C. L. Snow, president; Lewis McKeen, J. J. Arnold, J. H. Helmer, Geo. P. McClelland. Head office, Mabou Harbor, Cape Breton, N.S. The company owns and operates the Converse, Rankin, Beaton and McDonald gypsum quarries, the Florence mills and the Mabou coal mines, situate at Mabou Harbor, Cape Breton County, N S.; 50 persons are employed.

New Brunswick Coal Co., Ltd.—Authorized capital, $300,000. Directors—C. A. Boardman, president; Frank Todd, J. C. Stevens, jr., Henry F. Todd, J. J Doune. Head office, St. Stephens, N.B. This company's property comprises 700 acres in fee and 25 square miles under lease in the counties of Queens and Sunbury, upon which are certain workable deposits of coal. Not in operation.

New Glasgow Iron, Coal and Railroad Co., Ltd.—Authorized capital, $1,000,000. Directors—John F. Stairs, M.P., president, Halifax, N S.; Graham Fraser, Frank Ross, John McNab, Geo. F. McKay, J. Walter Allison, Harvey Graham. Head office, Ferrona, Pictou County, N.S. This company owns an extensive area of mineral lands in the County of Pictou, N.S. This company has the first coal washing plant put in operation in Canada; was first operted successfully May, 1892; works automatically, and requires the services of but three men Coking plant is situated near the coal washer, and the 54 ovens produce from 115 to 120 tons of first-class coke every twenty-four hours, which is all used in the blast furnace of the company; number of employés 480.

New Vancouver Cm. and Land Co.—Authorized capital, $1,075,000. Directors—John Galsworthy, John Fry, Wm Needham, Frederick Tendron, Edwin Andrew. Head office, 12 Old Jewry Chambers, Old Jewry, London. The company owns 32,000 acres of freehold land and operates the Nanaimo collieries, Vancouver Island, B.C. Northfield colliery, four miles from Departure Bay Nanaimo, employs 410 persons; No. 1 Esplanade, half mile from wharves, Nanaimo Harbor, employs 475 persons; Southfield mine No. 2, five miles south-east of Nanaimo, employs 200 persons; Southfield mine No. 3, two miles from Port Nanaimo, not worked in 1892, but employs 100 persons; Southfield colliery No. 5, situate five miles from Nanaimo, employs 158 persons; Protection Island shaft, situate half mile from Nanaimo, employs 125 persons. Output for 1893, 469,311 tons. John Rosenfeld's Sons, San Francisco, agents A large amount of this coal is sold in San Francisco.

Northumberland Coal Co., Ltd.—Authorized capital, $250,000. Principals—Thomas F. Wentworth, C. D. Ross, H. D. Walbridge, J. A. Blanchard, J. E March, J. O'Connel, F. W. Wedderburn. Being organized at date of report to mine in the Province of Nova Scotia.

Sydney & Louisburg Coal & Rail Co, Ltd.—The properties of the company in Cape Breton having been acquired by the Dominion Coal Co., Ltd, it is now being wound up.

Truro Cm. Co.—Authorized capital, $49,000. Officers—T. G. McMullen, Truro, president; J. W. Johnson, George Ross. Head office, Truro. This company is a reconstruction of the Colchester Coal Co, Ltd., and has been formed to operate certain coal areas, particularly those situate at North River, near Onslow, in Colchester County, N.S. In 1893 a good deal of work was done in opening up the property.

Wellington Colliery Co.—Owners—Robert Dunsmuir & Sons, Wellington, B C Jno. Bryden, general manager; General Overman, Alex. Sharp. Head office, Wellington colliery, Wellington, B.C. This company owns and operates the Wellington colliery, situate at Wellington, Vancouver Island, B. C. Value of plant, $150,000. Coal output for 1893, 337,334 tons; number of persons employed, 983.

CHARLES H. TAYLOR, the inventor of the new system of hydraulic air compression, of which a full description appears in this issue, was born at Miramichi, N.B., in 1859, and after leaving school adopted mechanical engineering as a profession when about sixteen years of age, and soon became a master mechanic and millwright, and has built mills in various parts of the Dominion. He subsequently turned his attention to mining, and has been employed as mining engineer in several mines in North and South Carolina and Colorado for about five years. It was while building a dam near Buckingham Station, Que., one winter, and watching the flow of water over the dam and under the ice, that the idea first suggested itself to him that air could be carried down with, and compressed by, the weight of the water. Having satisfied himself by tests that it could be done, he left to fill a mining contract in North Carolina, and on his return to Montreal last year, proceeded to develop the idea, with the result that he has perfected a system that bids fair to open up a large field for compressed air as a motive power.

WE would direct the attention of the Dominion Government to the letter of Mr. Baillairgé on the new Chicago Canal. If the result of building this canal is a reduction of one-thirtieth of the volume of water which comes down the Niagara and St. Lawrence Rivers, it will place our navigation interests in a very grave situation. In conversation with several Canadian engineers, more or less familiar with lake navigation, we find a great difference of opinion. One authority says it will make no appreciable difference in the level of Lake Ontario or of the two great rivers. Another says it will lower the level of Lakes Erie and Michigan by six to nine inches. If the level of the lakes is reduced by even one inch it becomes a grave question, and we believe Canada has clearly the right, if our lake and river levels should be affected, to demand the stoppage of this outflow, even though the canal is entirely within United States territory. A similar case occurred on the St. Lawrence a year or two ago, when the American Government were the complainants, and when a dam which was about to be built from one of the islands to the main land on the Canadian side was abandoned because of the danger of flooding lands on the American shore.

IN Hornsey, London, a new roadmaking material is obtained by collecting and burning the dirt of the district and using the coarsest of the clinker which is thus obtained. As a by-product, the finer clinker, after being put through a mortar mill, is mixed with lime or cement, thus forming a good mortar or grouting. The rest of the clinker is mixed with Portland cement, which makes very good paving stone.

Industrial Notes.

COLDWATER, Ont., council proposes to purchase a fire engine.

M. CROWELL has been awarded the contract for erecting gaol and Government buildings at Midway, B.C.

FAWCETT'S foundry at Sackville is working partially, some of the men having struck work owing to a cut in wages.

THE Canadian Engine and Locomotive Works Co., Kingston, Ont., have secured the right to manufacture the "Otto" gas engine in Canada.

THE Fairchild Vehicle and Machinery Co. (Ltd.), Winnipeg, is applying for incorporation, with a capital stock of $100,000. Among the applicants are F A., T. E., and J. H Fairchild, W Hutchison and G. E. Dixon.

THE Toronto authorities have at last awakened to the fact that economy in fire protection does not pay. They are about to add a Ronald engine, a Merryweather engine, and all other appliances required to meet future emergencies.

THE congregation of St. Matthew's Church, London, Ont., have resolved to build a new and larger edifice on the site of their present church. The cost will be about $10,000.

THE owners of the Port Discovery, B.C., saw-mills are going to spend $100,000 in improvements, and they will be operated soon to their full capacity of 300,000 feet per day.

THE Goldie & McCulloch Co., of Galt, got the contract for the three engines and boilers and other plant for the incline railway to be erected by the East Hamilton Improvement Co.

THE Hamilton Facing Mills Co. took action against the Quebec Fire Insurance Co. to recover the value of the contents of a small shed adjoining their four-storey factory building, and won the case. Defendants appealed, but the appeal was dismissed with costs.

THE annual general meeting of the Canada Paper Co. was held in Montreal last month. The usual reports were submitted and deemed satisfactory. Officers were re-elected as follows: President, John McFarlane; vice-president, Andrew Allan; secretary and treasurer, John G. Young.

THE Steel Sink Range Boiler and Stamping Company, of New Toronto, has gone into liquidation. The company was started three years ago with a capital of $37,000. Now the liabilities are $46,779 and the assets are placed nominally at $86,000, but it is not expected that much will be realized for the creditors.

H. GILLEN, architect, of Kingston, Ont., undertook to do the architectural work on a $25,000 building, the Hotel Quinte, Belleville, for $1,000 The actual cost of the building was $36,000, and he took out an action for a fee correspondingly larger. The judge decided that the hotel company were liable for the difference.

AN arrangement has been effected whereby the St. John, N.B., Gas Light Co. is absorbed by the St John Railway Co. This is under the terms of the legislative Act recently passed, which provides that the gas is never to exceed the present selling price. The total issue of bonds by the company is limited to $500,000. By a subsequent deal the electric light works are brought into the combine.

W. C. EDWARDS & Co are about to build an incinerator to burn the refuse and sawdust from their lumber mills at New Edinburgh, Ottawa, to be in readiness about the 1st of next month. It will be 80 feet high and about 20 feet in diameter, and will be constructed entirely of brick and stone. All through the mills carriers will be laid for the purpose of carrying all sawdust and edgings to the incinerator.

THE contracts have been let for the new Malleable Iron Works at Toronto Junction. They are to be called the Toronto Junction Steel and Malleable Iron Works, and W. H. Gore, of Elgin, Ill., is the chief promoter. The buildings, the main part of which will be 30 x 180, will be started as soon as the frost is out of the ground, and it is expected that operations will commence in June. About 25 hands will be employed.

THE annual meeting of the Intercolonial Coal Mining Company was held in Montreal last month, when the following were elected directors: J. P. Cleghorn, president; H. A. Budden, vice-president and managing director; Hartland S. MacDougall, W. M. Ramsay, E. Goff Penny, Thomas Wilson, Alex. Gunn, Angus W. Hooper and R. McD. Patterson. W. J. Nelson is secretary-treasurer. The sales of coal and coke for the year amounted to 213,946 tons, the largest in the history of the company. It was decided, however, to declare no dividend this year.

A PUMP factory is to be established in Prince Albert, Sask.

THE Nelson Sawmill Co will shortly establish a new mill at Rossland, B.C

ARRANGEMENTS have been made for putting in fire protection at Drayton, Ont.

ABOUT 30,000 tons of wood pulp were shipped from Nova Scotia to England last month.

H. L. CUMMINS is at work on a new bridge across the Kootenay River, at Fort Steele, B.C.

THE bridge between Kingston, Ont , and Pittsburgh will probably be rebuilt with steel or iron.

THE Vancouver furniture factory has been destroyed by fire Loss, $40,000; insurance, $3,000.

WORK will be begun at once on the new bridge at Edmonton, N.W.T., across the Saskatchewan.

GILMOUR & HEWSON, lumbermen, Hull, Que ,will add two new boilers and enlarge their boiler house

A HOUSE of refuge for the counties of Chambly, Vercheres and Laprairie is to be built at Longueuil, Que.

IT is now stated that the proposed city plant in Toronto for asphalting will cost $25,000, not $5,000 as estimated.

GRAY & ALLEY, Rock Bay, Victoria, B.C , are enlarging their woodworking factory and increasing their power plant.

THE Hamilton Board of Education is asking for the building of a new Institute. The cost is estimated at $75,000.

THE Pacific Casket and Furniture Co 's factory at Vancouver, B.C , has been burned. Loss, $4,000 , insurance, $3,000.

THE Belleville Gas Co. invite tenders for the erection of a dam and flume on the Moira river above the railway bridge near that city.

THE Gananoque, Ont., Board of Education are asking the council for $15,000 for the purpose of building a new High School

HALIFAX, N.S , council are about to add a new chemical engine to their fire protection equipment, and also build a new engine house.

A COMPANY is to be formed in Berlin, Ont , for the purpose of manufacturing a threshing machine and band cutter, of which Mr Kleinstuber is the inventor

SOME St John capitalists have taken hold of the old McFatridge foundry at Fairview, N.B. It is the intention to use it for converting old iron into pig.

JOHN BOYD & Co , metal brokers, Vancouver, B.C., have dissolved partnership, W. L Newsom having retired The business will be carried on by John Boyd and Fred J Burns.

A NEW two-storey bathing house is to be built in Preston, Ont., to cost between $8,000 and $10,000 It will be fitted up with all kinds of baths, swimming, Turkish, steam plunge and electrical.

OTTAWA city council have decided not to submit the $45,000 by-law for the erection of a new fire station at the south end and other improvements until January next, the time for the elections.

THE Dominion Government took out an action against the St. John, N.B., Gas Company, to restrain them from depositing refuse in the harbor. An injunction was granted so far as tar was concerned

THE Grand Falls Water Power Co., Fredericton, N.B , have been granted by the Victoria county council a lease of the common at Grand Falls, provided they will expend $10,000 in surveys, labor and improvements.

D. W. HOEGG & Co., Fredericton, N.B., have accepted the city's offer of free water and exemption from taxation for five years, and will rebuild their canning factory on the site of the one burned last spring. Work will be commenced shortly.

THE London, Ont., Gas Company have recently adopted improved methods of manufacture, and have received new machinery, and they have now decided, in order to meet the increasing opposition of the incandescent electric system, to reduce the price of gas from $1.50 to $1 net per thousand.

PONTBRIAND & FRERE, Ltd., are applying for incorporation in order to carry on the business of manufacturing engines, boilers, saws, etc., at Sorel, Que Capital, $50,000 The applicants are H. Beauchemin, P Beauchemin, A. E Pontbriand, A. Monarque, and J. B. O Pontbriand, all of Sorel.

THE Dominion Specialty Mfg Co. (Ltd.), Toronto, capital stock $25,000, are applying for incorporation, for the purpose of buying and selling useful inventions, and of purchasing rights for manufacturing under certain patents. N. M. Cantin and O. Bissonnette, both of Toronto, are the leading spirits.

A STOVE foundry is to be established in Napanee, Ont.

THE Jeffrey Hale hospital governors at Quebec are to erect a new $150,000 building in that city.

JOSEPH NOBLE, of Rusagomish, has the contract for building a bridge across the river at New Maryland, N.B.

A NEW bridge is to be built over Connell's Creek, on the township line between Eldon and Thorah, Ont.

TORONTO School Board have decided to recommend the expenditure of $115,000 on additional school accommodation.

ALBERT E. KINCH has assumed the entire charge of the Ontario Iron Works, Peterborough, formerly carried on by Moffatt & Kinch.

THE Brampton, Ont., council have decided to build a new bridge. It has not been decided yet whether it will be of iron or of wood

ST LOUIS DU MILE END council will spend considerable sums of money during the next year or two in improving the drainage in that district.

THE Department of Railways and Canals has awarded the contract for a new swing bridge at Wellington, over the Rideau canal, to the Canada Bridge and Iron Co.

M. MCINTYRE is going to utilize the water power at Boundary Falls, B C., in operating a sawmill and a ten-stamp mill, which he intends erecting near that point this month.

E. R C. CLARKSON, Toronto, has been appointed liquidator of the Steel Sink Range Boiler and Stamping Co., New Toronto, owing to the failure of several of its prominent stockholders.

J J. MCLAUGHLIN, the disastrous explosion at whose mineral water factory in Toronto was chronicled in last number, will start rebuilding at once Electric power will in future be employed instead of steam.

MONCTON, N.B., city council have awarded to the Toronto Rubber Company a contract for supplying 500 feet Surprise double-jacket hose, and one to the Toronto Gutta Percha Rubber Company for 500 feet rubber-lined Baker fabric.

THE creditors of Bracey Bros. & Co., contractors, Hamilton, met last month, and statements were presented. The assets are placed at $68,735 and the liabilities at $62,599. In this, no allowance is made for the penalty for non-completion of contract within the specified time, and there is likely to be a lawsuit over the matter.

TORONTO Board of Works have awarded contracts for paving the track allowance on Avenue road as follows: Construction and Paving Co., from Bloor street to Davenport road, asphalt and scoria block, $11,112; asphalt and granite sets, $10,278; D. L. Van Vlack, from Davenport road to C P R. tracks, cedar blocks on concrete, $3,220

THE Carey Wire Sewing Process Co. of the Dominion of Canada (Ltd.) have, under supplementary letters patent, changed their name to the Carey Wire Sewing Machine Co. (Ltd.). Besides carrying on the business of manufacturing and dealing in sewing machines, they will have the right to acquire letters patent of inventions relating to the same.

A BOILER in S. T King & Son's saw mill, at Kingsville, N.B., exploded last month with terrific violence, one man, Wellington Smith, being killed, and eight injured more or less severely. The loss will be considerable, as the boiler room was completely shattered with all its contents; covered by insurance only against fire The mill had only been in operation about a fortnight after a long shut down The exact cause of the explosion is not yet ascertained.

THE St Louis du Mile End council, Montreal, have resolved to drain the entire municipality upon an improved system. The drain will have to be cut in solid rock. Work has already commenced on Clarke avenue, where Bastien & Valiquette have 150 men employed in constructing an immense drain. Up to the present, about $167,000 has been spent, and it is probable that before the work of drainage is completed, about $1,000,000 will have to be expended

THE result of the arbitration in connection with the Peterborough, Ont., outfall sewer was that that town is authorized to extend the sewer through North Monaghan, and to discharge the sewage into the Otonabee River within the limit of that township for a term of five years. After that period it will have to adopt such means as may be necessary to effectually dispose of any dangerous elements before discharging the same into the river within the limits of the township of North Monaghan.

THE Ingram bridge at Midway, B.C., is now nearly completed.

THE new gaol to be built in Hamilton is to cost about $30,000.

THE Independent Order of Oddfellows will erect a $200,000 building in Toronto.

THE by-law passed last year for the drainage of Dalhousie Ward, Ottawa, has been repealed.

KALTE & POOLE, Berlin, Ont., have taken over the Port Elgin foundry and will at once begin operations.

A NEW cartridge factory is to be established in Quebec. A quantity of new machinery to be installed in it is on its way from England.

TORONTO city engineer has had plans prepared for a new machine shop in connection with the waterworks department. The cost will be about $7,000.

A PARTY unknown offers to subscribe $1,000 for the construction of public urinals and closets in a central part of Toronto. The total cost would be about $2,000

SAMUEL ALCOTT, foreman at the Port Hope, Ont., file factory, a few days ago had his eye badly burned by melted lead. The injury is painful, but will not probably affect the sight.

MONTREAL GAS Co. have now stated definitely that they will not sell gas at the rate contracted for by the Coates Co. They say that the company which actually carried out such a proposition could not live.

THE Royal Paper Mills Co., Montreal, have bought the mill lumber and other property at Brompton Falls, Que., and will erect at East Angus a large sawmill The Brompton mill will be utilized to manufacture ground pulp.

ST. ANDREW'S Presbyterian Church, Windsor, Ont., was last month destroyed by fire, and the manse and lecture room were badly damaged. Loss about $20,000; insurance $10,000. The fire is supposed to have started from the furnace. The church will be rebuilt at once.

THE well-known belting firm, the J. C. McLaren Belting Company, Montreal, is to be turned into a limited liability company. The incorporators are David W. McLaren, Mrs. A Cummins Walker, Alexander Walker, B. S. Sharing, Joseph Ryan, and G. W McDougall, all of Montreal. Capital, $99,000.

THE Ontario Veneer Co (Ltd.), Toronto, are applying for incorporation. Capital stock $20 000 They will manufacture veneers and veneered goods, cheese boxes, cooperage stock, wooden carriage furnishings, builders' lumber and supplies, etc Among the applicants are W. Alex. Gunn, H L. Dance and Geo. Bennett, all of Toronto.

THE Three Rivers, Que., Iron Works Co., capital stock $100,000, have been incorporated They will manufacture iron, steel and brass wares, gas and water pipes of all kinds, foundry appliances, and will carry on the manufacture and supply of electric light, heat and power Hector McRae, of Ottawa, and W Duncan, of Three Rivers, are largely interested.

THE Doherty Manfg. Co., Sarnia, Ont., are introducing into their foundry a method for producing what is called ferreous steel. This is a fair quality of steel, quite malleable in its nature, that will punch cold, coil up under a lathe or planer tool, and is equal in ductility to the commoner grades of basic steel. It can be made direct from the cupola without the use of a converter.

JOSEPH H STILES, who proposed the holding of an International Exhibition in Montreal next year, has just returned from Europe, where he has been endeavoring to interest the various manufacturers and foreign governments in favor of the scheme. From all accounts he met with very encouraging success, and besides this, he has received offers from many of the managers of the chief attractions at the Chicago World's Fair to repeat their exhibits in Montreal. There is little doubt that the exhibition would be a success, and a deputation of the Montreal Board of Trade to Ottawa has endorsed the scheme.

A CASE came before the courts recently in connection with patents which will be of interest to manufacturers generally. E. B. Eddy, of Hull, was charged with offering for sale a certain fibre wash basin as a patented article, the same not having been patented in Canada. The defence proved that a patent had been taken out for the machine and process, and contended that this covered the product also. The case was dismissed, but subsequently a similar charge was laid against T. Weldon, Toronto, manager of the E. B. Eddy Company, and this remains unsettled. The case is a difficult one, for if the articles had been put on the market without bearing any stamp to show they had been through the patent office, it would have been an infringement of the law also.

A NEW poor-house is to be built in Truro, N.S.

isolation hospital is probably to be built at Lindsay, Ont.

A. LAVALLEE, contractor, Montreal, has assigned. Liabilities about $20,000

NOTRE DAME Convent, Montreal, is to have a branch at Megantic, Que.

IT is proposed to build a traffic bridge over the Bay of Quinte, near Deseronto.

ABOUT $45,000 is to be expended in Ottawa on additional and improved fire protection.

H. C. REEVES, South Woodslee, Ont., has decided to rebuild his stave mill, recently burned down.

WINDSOR, Ont., Presbyterian Church has been destroyed by fire. The damage is estimated at $20,000; partly ·. ired.

LINDSAY, Ont., council have decided to buy the local company's waterworks, the price to be probably fixed by arbitration.

THE St. Lawrence bridge at Wellington, Ont., over the Rideau River, has been taken down. A new iron structure will be erected.

THE authorities of the Deaf and Dumb Institution, Halifax, are building two extensions to cost $43,000 and $25,000 respectively.

THE Blaine Window Confection Mfg. Co., of Alliance, O., are thinking of establishing a branch factory in this country, probably in Hamilton.

THE Krupps have discovered a new hardening process which materially increases the resisting power of armor plates. Some wonderful results are looked for.

GILMOUR & HUGHSON'S great lumber piles on the Gatineau River, near Ottawa, were last month completely destroyed by fire. Loss about $200,000; partially insured.

DIGBY, N S., council are calling for tenders for a loan of $35,000 for the purpose of constructing a town system of waterworks. Work will be commenced this spring.

MR. BANCROFT, on behalf of the neighborhood of Clarke's Ferry, N.S, is petitioning the Legislature to construct the long-talked of bridge over the Annapolis River at that place.

WM. T. BONNER, of New York, has been appointed general agent for Canada for the Babcock and Wilcox Co., manufacturers of water tube steam boilers, in the place of E. C. French.

J. R. BOOTH, of Ottawa, and Thos. Hale, of Pembroke, have purchased timber limits 136 and 137 from Campbell & Co., Ottawa, for $350,000. The limits cover an area of 72 square miles.

M. SLITER, engineer in Thomson & Avery's saw-mill at Sharbot Lake, near Kingston, Ont., was caught in the belting and had two legs fractured below the knees He died shortly afterwards.

THE Guelph, Ont., Pavement Co. (Ltd.) have completed organization with a fully subscribed capital of $25,000. The following officers have been appointed: President, W. J. Bell; vice-president, Col Higinbotham; secretary, A. F. H. Jones.

W. ARCHIBALD, proprietor of the Empire Tobacco Factory, Montreal, is thinking of removing his factory to St. Johns, Que. He guarantees that his factory would employ 250 hands, with a minimum pay list of $40,000, provided the town grants a cash bonus of $30,000.

THE Wallaceburg, Ont., Glass Company has been organized, with the following officers: President, Capt. J. W. Steinhoff; vice-president, D. G. Mitchell; secretary-treasurer, A. G. Laird. A capital of $50,000 has been subscribed. The works will begin to turn out glass this month.

OWING to the sudden bursting of a water main on Sherbrooke street, Montreal, last month, St. Denis street and its vicinity were flooded for several hours, the water rushing down the slope in torrents. A good deal of damage was caused to the houses *en route*. The burst pipes, which had been in use some years, were bought in Scotland.

ENGINEER HASKINS, of Hamilton, proposes the erection of a stand-pipe, in order to remedy the lack of pressure in the water supply of that city. He does not consider that plan so satisfactory as the construction of a new high-level reservoir, but proposes it as the next best thing. In addition to the stand-pipe, two engines would have to be put up.

ARCHITECTS BURKE, of Toronto, and McBride, of London, Ont., have presented their plans of the new Methodist church on Queen's avenue, London, to replace the edifice which was burned down recently, and they have been approved of. The estimated cost is $65 000, and its seating capacity will be about 1,650. The main tower will be 136 feet high and the second 80 feet.

Mining Matters.

THE Ridgetown, Ont., Gas Company have decided to go on with boring work.

FRANK HILTON has begun work on a new shaft on the "Little Falls" claim, Big Bend, B.C

ON the "Yakimaw," near Nelson, a vein has been discovered with four feet of good ore The claim is owned by N. D. Moore

THE Country Harbor, N S., Gold Mining Co., a week or two ago, turned out a brick of gold weighing 96 ounces, worth about $1,800.

THE Warren lead in Guysborough county, N.S., is showing some gold, but so far the company have not sent any of the quartz to the mill.

THE Tudor Gold Mining Co (Ltd.), Waverly, N.S., have purchased a large Worthington pressure pump to handle all the water from their workings

MR MONAHAN, managing proprieter of the Cariboo claim at Camp McKinney, recently took with him to Seattle gold bricks, the output of the mine for the previous three weeks, valued at $16,000.

THE Black Creek Hydraulic Mining Co. (Ltd.) Vancouver, B.C., have been incorporated, with a capital stock of $300,000 The trustees are W F Salsbury, E. Mahen and Johann Wulffsohn, of Vancouver.

D. A. MCDONALD, manager of the Pictou Development Mining Co. at Renfrew, N S., was in the city last week with a fine lot of quartz, obtained from a new streak 230 feet below the surface, which promises to give good returns.—*Canadian Colliery Guardian.*

THE "Empire" claim at Fairview, B.C., has a lead about 3½ feet wide, running north and south, which is traceable through nearly the entire length of the claim. Some fine free gold specimens have been taken out. Mr Kline, the owner, is endeavoring to bring in capital for further development

A BED of iron ore containing, it is said, about 600,000,000 tons, has recently been discovered at Conception Bay, about twelve miles from St. John's, Nfld Analysis shows it to be the finest hematite ore, containing 89½ per cent. of iron. The New Glasgow Iron and Coal Co., New Glasgow, N S., are making preparations for working it on an extensive scale

SOME well-known British Columbia mining men are forming a syndicate with large capital to purchase claims from small mine owners, and afterwards sell concessions to wealthy corporations At present, owing to the lack of means of many prospectors, their claims, some of them of great promise, remain in the elementary stages of development. All this would be altered very materially.

THE gold mine at North Brookfield, N.S., is running as usual, keeping the mill busy night and day, reports the *Canadian Colliery Guardian* A survey is being made of the underground works, which shows the existence of a "lead" about 150 feet in depth, dipping west at an angle of 25 or 30 degrees This has been followed for 250 feet, and there are indications that it continues much further

THE Wiegand Gold Mining Co. have been incorporated for the purpose of developing the property on Shoal Lake, near Fort William, Ont. One shaft is already down 14 feet and is under contract to be sunk 100 feet. The vein is described as a true fissure vein, 6 feet between the walls, carrying 2 feet of high grade quartz, assaying all the way from $28 to $210. A stamp mill is expected to be in operation about the middle of next month, with a capacity of 30 tons per day The officers of the company are. President, Joseph C. Foley, vice-president, V D Cliff, secretary, J. J. McAuliffe

THE annual meeting of the Mining Society of Nova Scotia was held at Halifax on the 13th ult. Among the papers read were the following. Notes on a mineral collection, prepared by the Government of Nova Scotia for the Imperial Institute, London, by E. Gilpin, Jr., Inspector of Mines; Boilers, tests and efficiency, by W. G. Matheson. On surface surveys and the necessity of contour surveys in gold districts in Nova Scotia, by Dr. Martin Murphy. A novelty in coal mine ventilation, by Alex. Dick; Notes on the behavior of some gold solvents, by F. H. Mason; Notes of a trip to Alaska and its gold mines, by Geo. MacDuff. The following were appointed officers for the present year President, R. H. Brown. Vice-presidents, Graham Fraser, Charles Fergie, and W. Blakemore; hon.-secretary, B. T. A. Bell; secretary-teasurer, H. M. Wylde. The Council will endeavor to organize a mining exhibition in Montreal as soon as possible.

WHILE at work on the lowest drift of "Silver King," Kootenay, the diamond drill ran through 7 feet of good ore.

JAMES ROBINSON of the Hillsboro, N.S., mines, is prospecting for coal in that neighborhood He has a crew at work sinking an 8x12 shaft.

N D. MOORE has transferred the "Cumberland" mine, near Nelson, B.C., to W. C. Yawkey for $25,000, to be paid $15,000 in cash and the balance in six months.

ACCORDING to returns made to the collector of customs at Nelson, the shipments of ore from South Kootenay mines during last year amounted in value to $784,965.

THE Lake Gerard Mica Mining Co 's mine, "The Phosphate King," has been dug to a depth of 70 ft. Operations will be continued on a still more expensive scale during the summer.

A SIX foot vein of coal has been discovered at a depth of 250 feet at Stephen, near Rainy Lake City. It seems to be a good quality of soft coal A company is to be organized to work it.

THE "Silver King" Company, Kootenay, B.C., are sinking a shaft on the "Daylight" claim, the third extension on the east of the "Victoria." This claim carries gold ore in paying quantities.

THE first shipment of ore from Ten-mile Creek, near Slocan Lake, took place last month in the shape of a carload from the "Kalispel" mine. The ore is high-grade, similar to that on the "Fisher Maiden."

SEVERAL experiments have been made recently to test the value of the iron ore in Madoc township, Ont., and vicinity, and seem to have given fair satisfaction. Extensive developments are looked for in the near future.

THE Nelson, B.C., Hydraulic Mining Co. are getting ready as quickly as possible for spring work. New sluice boxes are in, and work has commenced on a new flume, which will be 3 ft. by 2 ft. Two vibrators will be worked.

THE Humphries-Moore concentrator at Nelson, B.C., began the work of reducing ore last month. Its supply is drawn chiefly from the Alamo and Idaho mines, but this spring a large quantity will probably come from the Mountain Chief.

THE Danville Asbestos and Slate Co., Montreal, are applying for incorporation. Capital, $150,000. The provisional directors are Feodor and Moritz Boas, of St. Hyacinthe; J. W. Greenshields, W. Sclater, B. Shepherd and W. T. Costigan, of Montreal

ON the "Goodenough" claim, Slocan district, B.C., the crosscut tunnel caught the vein in 67 feet, and drifts are now being run both ways. It carries about 6 inches of carbonates mixed with high-grade galena, an average sample assaying 480 ozs. silver.

THE Slocan, B C., district is looking up. Close after the news of a big discovery on the Alpha mine and the immediate resumption of shipments, came word that a fine body of ore had been struck on the Wonderful, and also that ore had been found in both tunnels on the Ivanhoe.

LAST month the shaft house at the Sultana gold mine, near Rat Portage, Ont., caught fire and was burned. The flames and smoke shut off the air supply to the mines, and twenty-four miners at work were only rescued with difficulty, one being killed. The fire started from a tobacco pipe.

THE business men and manufacturers of Nelson, B.C., offer to guarantee money and land subscriptions to the amount of $100,000 for the location and operation in that town of smelting works Among those who have the matter in hand are G. A Bigelow & Co., W. F. Teetzel & Co. and Thos. Madden.

A. D WHITTIER has just returned from a visit to London, Eng., where he has succeeded in forming a company to work the hydraulic mines on Williams Creek, Cariboo, B.C. The capital is $500,000, of which $200,000 is paid up. The first operations undertaken by the company will be in the Ballarat claim.

THE Intercolonial Coal Mining Co are putting in a ventilating fan of 30 ft. diameter, with a capacity of 200,000 cubic feet of air per minute, to be driven by a pair of tandem compound engines built by an English firm. They are also putting in a patent English screen with a capacity of 500 tons or more per day. The company are preparing to reopen a slope that was abandoned some years ago.

THE Standard Oil and Gas Company are going to explore Pelee Island, Ont., for gas and oil, and George Lypps, on behalf of the company, has leased several thousand acres and will begin operations in a short time. The Ontario Natural Gas Company have also secured options on tracts of land on the island. The indications point to a large amount of oil and gas in the island at present not utilized.

THE average daily output from the Joggins, N.S., mines for the past year has been about 550 tons.

ONE hundred thousand tons of gypsum were shipped from Hants County, N.S., to New York last year.

THE McCullough Creek Tunnel Co., Big Bend, B.C., are getting ready to sink a winze for bed-rock. They are in about 200 feet.

THE famous Gaspé oil well, when struck first, sent a column of oil 30 feet into air; about 500 barrels of oil were lost before it could be plugged.

DILL BROS. have sold their plaster quarry in Ste. Croix, N.S., to Knowles & Co., of Avondale, for $10,000. The plaster available is estimated at $100,000.

THE men at the Springhill, N.S., coal mines demanded a three-quarter shift, or eight hours pay for six hours work, and upon this being refused, struck work.

J T. SMITH, of Amherst, N.S., is engaged in developing his coal property at Maccan, and has sunk a slope to the depth of 100 feet on the seam recently discovered almost opposite the I.C.R. station.

THE Bordeaux Chamber of Commerce has petitioned the French government to place Canadian petroleum on the minimum tariff list, so as to allow it to compete on even terms with Russian and American oils

THE Montreal Quarry Co., capital $200,000, have been incorporated. The incorporators are Peter Lyall, contractor; P. Alex. Peterson, civil engineer; D. A. McCaskill, merchant; W. G. Reid, contractor, all of Montreal.

MR. BUTTERFIELD has resumed work on the Pleayune, Chester Basin, N.S. The test shaft is to be sunk 50 feet deeper, making it a total depth of 225 feet. He will also open the westerly extension of the "Captain," which is 18 inches wide.

AN English syndicate offers to purchase some large coal areas lying between Sydney and Mira, C.B., for $50,000. Experts declare that this district contains one of the finest seams yet discovered. An interest would be retained by the present owners.

THE Anglo-Canadian Gold Mining Syndicate, New Westminster, B.C., has been incorporated, with a capital of $250,000. The company own 320 acres of gold-bearing gravel benches on the south fork of the Similkameen river. Water will be obtained from the river at a cost of $40,000, and the work of development will go on at once

JOHN BROWN reports that fully 30 men are working on Trout Creek, B.C., at present, and are making about $2 per day. On the Breckenridge claim about 500 feet have been wing-dammed. A good deal of work has been done recently in the way of putting in flumes for washing The coming summer is expected to prove a good one in the district.

THE shaft on the Smuggler Mine, Fairview, B.C., is now down 40 feet The ore is said to improve with depth, and the vein, as yet, shows no sign of becoming thinner. Average assays give $22 in gold. A second vein has lately been opened up on the same vein, showing four feet between walls of well mineralized quartz. Mr. Elliott is supervising this work.

LAST month G. Hamilton, of Youngstown, Ohio, and G. Caulfield, of Cleveland, Ohio, of the Dominion Steel and Blast Co., had a conference with Kingston, Ont., City Council, with a view to the establishment of a blast furnace and rolling mill there. They want to erect buildings immediately near the mines. The plant would cost about $600,000. The company asked the council for a free site, exemption from taxes and free water for a term of years, and to guarantee the interest on the bonds of the company to the extent of $300,000, taking a first mortgage on the plant as security. The government bounty is estimated at $100,000 per annum. If Kingston fails to offer these inducements, the works will probably be located in Belleville.

THE curious discovery has been made by Charles Margot, of the University of Geneva, that when aluminum is rubbed upon glass, the latter receives brilliant markings which cannot be washed away. The effect is most pronounced when the glass is wet. With a small aluminum wheel, M. Margot traces ornamental designs upon glass, and by burnishing with a steel tool gives them the appearance of metallic inlaid work. The adhesion is complete. Aside from its probable value as a means of decorating objects of glass, this property of aluminum is useful as a convenient test of the diamond, which is absolutely unaffected, while all siliceous substances are very perceptibly marked by the metal.

Railway and Marine News.

THE G.T.R. will perhaps build a new freight and passenger station at St. Henri.

THE Toronto, Hamilton, and Buffalo Railway steel bridge over the Hamilton and Dundas track is about finished.

THE Ottawa, Arnprior & Parry Sound Railway Co. will, this summer, build a roundhouse and car shops at Ottawa.

THE New Brunswick Government are calling for tenders for the construction of a wharf at Gray's Point, Belleisle, N.B.

THE Temiscouata Railway are about to apply to Legislature for power to extend their line to a point on the I.C.R., near Moncton or Berry's Mills.

TORONTO Board of Trade and city council have come to the conclusion that all they can do for the proposed St. James' Bay Railroad is to give it their moral support.

THE St. Lawrence River Steamboat Co.'s new ship, the "America," is making satisfactory progress towards completion, and will be ready for navigation towards the end of May.

HENEY & SMITH, who were the successful tenderers for asphalt paving in Ottawa, having objected to the form of contract, the city council decided to throw out all the tenders and to call for new ones.

SOUTH GRIMSBY, Ont., ratepayers have decided in favor of issuing debentures to the extent of $4,000 and of granting exemption from taxation for twenty years in favor of the Toronto, Hamilton and Buffalo Railway Co.

W H COMSTOCK, of Brockville, Ont., has purchased the plant and lease of the Hanlan Ferry Co., Toronto, for $40,000. He is purchasing the steamer "City of Windsor," and will place her on the route between Kingston and Oswego.

THE Canada Southern Railway Co. are applying to Legislature for an Act authorizing them to extend the time for the commencement and completion of the branches of their line still unconstructed, and empowering them to lease the Leamington and St. Clair Railway Co.'s line.

THERE was a report abroad last month to the effect that an agent of a wealthy English syndicate was in Montreal for the purpose of negotiating with the Richelieu and Ontario Navigation Co. for taking over their business and vessels, but there is no likelihood of anything of the sort happening.

THE Department of Trade and Commerce of the Dominion Government are calling for tenders for a mail service between Canada and Antwerp, for a period of five years from July 1st next, the service to be fortnightly in summer and monthly in winter. The capacity of the steamers is to be not less than 2,500 tons each, and the speed not less than 13 knots per hour. Tenders must be in by May 1st.

N K and M. CONNOLLY, of Quebec, who have the contract for building the continuation of the Baie des Chaleurs Railway from Caplin to Paspebiac, are making active preparations for commencing operations, and hope to have it completed by September next. The line now forms a part of the Atlantic & Lake Superior Railway, and forms a junction with the I.C.R. at Metapedia. A large bridge over the Bonaventure River is still to be built.

MAYOR SUMNER, of Moncton, is bringing before the New Brunswick Legislature a bill relating to the proposed dock for that city. The promoters ask for a subsidy of $25,000 from the Provincial Government, the city having already granted a similar amount. They will probably obtain a subsidy of $25,000 also from the Dominion Government, and expect to raise the balance of $100,000 by private subscription. This will be enough to make a start on the work of building, and it is thought that when the dock is completed several manufactories will be attracted to Moncton.

DAVIS & SONS, shipbuilders, etc., Kingston, Ont., have the steamer "Maud" well under way in their dry docks. Her steel frames are all up and the bottom is nearly all planked. She is 160 feet long and 36 feet wide over the guards. She will be ready to float on opening of navigation. This firm's launch department is in full operation. They have a contract with Rev. E. M. Bland, of Hamilton, for a new 33 ft. steam launch. There are three yachts also under way. They are also constructing six of their new patent single-acting compound engines. These engines are supplied with improved Porcupine boiler, rating six horse power, the whole machinery weighing only 720 pounds. These boilers are tested to 300 pounds cold water pressure.

THE C P.R , who bought recently the Yonge street wharf at Toronto, are about to improve it

CARVETH & TEBB are opening in Peterborough, Ont., a new factory for the manufacture of canoes

THE steamship Barcelona, of Halifax, is now making trips direct to Manchester, Eng., via the new canal

THE Canada Atlantic Railway Co. deny the report that they are about to build a branch line to Cornwall, Ont.

PLANS are ready for the new Canada Atlantic Railway at Valleyfield, Que , and work will be commenced as soon as possible

THE vessel "Earnscliffe," belonging to A. & W Smith, Halifax, went ashore off the East Indies last month, and will probably prove a total wreck. Loss about $30,000.

THE Montreal Warehousing Co. have elected the following officers President, L J. Seargeant, vice-president, W M. Ramsay; manager and secretary, G A Hanna.

THE Private Bills Committee of the Ontario Legislature have passed, with a few slight alterations, bill No 14, confirming the bonus of $225,000, in aid of the Toronto, Hamilton & Buffalo Railroad Co.

THE C.P.R will temporarily close the Lake Temiscamingue Colonization Railway, in order to thoroughly overhaul the engines and repair the rolling stock Further facilities are to be provided for lumbermen.

THE Calvin Company is building a large steam barge at Garden Island. The dimensions are 180 feet long, 37 feet beam and 13 feet hold She will be able to carry 40,000 feet of oak timber, and will be fitted up with a new Hazlett boiler.

ALL the pillars on the new railway bridge being constructed by the Gt. Northern at Grand Mere, Que., over the St. Maurice River, are completed. The contract for the iron work has been awarded to the Dominion Bridge Co , Lachine

THE Victoria, Vancouver and Westminster Railway Co have been incorporated They will build a line from a place near Garry Point on the Fraser River, through Richmond, South Vancouver and Burnaby to Westminster, with a branch to Vancouver

THE people of Charlevoix county are protesting against the Quebec Government's action in allowing the Quebec, Montmorency and Charlevoix Railway Co. to relinquish their line to Murray Bay, as formerly projected, in return for the non-payment of the subsidy of $302,000 promised them.

THE Black line steamer now on the stocks at Simpson's yards, Collingwood, Ont., is making rapid progress towards completion The gallows frame is in position, as are also the stanchions between decks Boiler makers are at work putting in a new bottom on the boiler and the engines are being erected

THE proposed freight ferry from Cobourg across Lake Ontario to Oak Orchard Harbor or some other convenient point on the American side, is taking more definite shape The capital stock of the companies which have the matter in hand is about $500,000, Robert Avery, of New York, being president.

THE contract which Hugh Sutherland, president of the Winnipeg Great Northern Railway Co , recently entered into with the Dominion Government has been approved of by Order-in-Council. This contract provides for the construction of a railway from Winnipeg to Hudson's Bay at the rate of 200 miles per year.

T SENERAC took out an action against the Central Vermont Railway Company to recover $30,000 damages on account of the alleged loss of valuable property at Stanbridge, owing to a spark from a passing locomotive The action was dismissed on the ground that the evidence did not bring home the responsibility for the accident to the negligence of defendants

OTTAWA Division No 168 of the Brotherhood of Locomotive Engineers have elected the following officers Chief engineer, A Hudson; 1st engineer, F Rowe, 2nd engineer, H Clendennin, 1st assistant engineer, W. Prenter 2nd assistant engineer, N Gadbois, 3rd assistant engineer, T Chapman, guide, W Botherall; chaplain, W. Graham. A Hudson has been elected representative of the committee of adjustment for the C.P.R.

GEO A MOUNTAIN, chief engineer, and Geo. I Root, of the engineering staff of the O . A. & P S Railway, have returned from Long Lake, where they have been laying out work for pile driving, which has begun along the shores of the lake. Long Lake has so many small bays that two or three miles of pile driving and trestle work will have to be done in building the line past the lake Between seventy-five and a hundred men are already employed at this work. Rock cutting will begin in a few days on the first section beyond the present terminus of the line.—*Ottawa Journal.*

CAPT E DUQUETTE will run a steamer between Cornwall and Valleyfield

THE steamer "J. L. Murphy" is at Sand Point, Ont., undergoing repairs to her boilers.

THE works of the Gilberts' Boat Co., Gananoque, Ont., will be removed from that place to Brockville

THE Facer Hammered Solid Steel Car and Locomotive Steel Co (Ltd) are shortly going to begin work on their new factory.

THE Dominion Atlantic Railway Co are going to make extensive improvements on their line this spring. Three station houses will be built.

R O & A B MACKAY, Montreal, will probably run the steamers "Acadia" and "St. Magnus" between Windsor and Montreal, instead of from Toledo.

WORK at the deep-water terminus at Halifax, which was recently destroyed by fire, will be started at once. A sea-wall will likely be built from the Cunard wharf to the dockyard.

THE London, Ont., Merchants' and Manufacturers' Steamboat Co. (Ltd.), with a capital of $50,000, are applying for incorporation. John McClary, F. Leonard and Geo. Gunn are interested.

THE Columbia & Kootenay Navigation Co.'s steamer "Spokane" was last month burned to the water's edge. The cause of the fire is unknown. Loss, $15,000, besides cargo: insurance, $5,000

THE Dominion Construction Co have decided to go on with the Hunter street tunnel, Hamilton, as soon as the track laying for the Toronto, Hamilton and Buffalo Railroad is completed to the city.

WILLIAM HEALD, railway contractor, Arnprior, has been awarded the contract for the construction of a section of the Ottawa, Arnprior and Parry Sound Railway, east of Parry Sound. Work will start immediately.

THE Toronto, Hamilton and Buffalo Railroad will spend $600,000 in Hamilton in building the line from Garth street to the eastern limits of the city, erecting a station and freight sheds, etc This does not include the cost of car shops

THE C P R. are building a branch between Fort Frances and Rainy Lake City, tapping the gold country lying between those points. The Mesaba Northern Railway and another company had been contemplating taking a similar step, but are now cut out.

THE 1,300 ton barque "Annie Stafford," of St. John, N.B., was last month totally destroyed by fire in Dieppe harbor, France Loss about $30,000 The fire is supposed to have been originated by some flints (with which the vessel was ballasted) setting fire to the woodwork, which was saturated with petroleum

D D WILSON, S. Harkness, H. Youlden, J. Hewton, J. Breden and Mr Walton, all of Kingston, are forming in Toronto a company for the purpose of manufacturing magnetic engines for yachts. The engine works by means of magnets only, and, it is claimed, gives better speed than either steam or electricity as ordinarily utilized

THE Great Northern Transportation Co., Collingwood, Ont., are making arrangements for the calling of the propeller "Pacific" at Windsor and Sault Ste. Marie. The vessel, which will be replaced by the new one now in course of being built for the company, will probably be employed on the Windsor, Sarnia and Sault Ste. Marie route

W. BROWN, shipbuilder Vancouver, B.C., has just turned out a new schooner, the "Queen City" It is 128 feet long, 23 feet 6 inches beam and 10 feet deep in the hold. She is capable of carrying 250,000 feet of lumber. A barquentine is also being built at the same yard, 160 feet long, 38 feet beam, 15 feet depth of hold, capable of stowing away 800,000 feet of lumber

MONTREAL Harbor Board has awarded contracts as follows Bar-iron and waste, B J Coghlin; pressed spikes, Peck, Benny & Co., long wharf spikes, R Donaldson & Son cut nails, Lewis Bros & Co; bolts, nuts and coach screws, Pillow, Hersey Mfg. Co., washers, Frothingham & Workman, oakum, James Wilson & Co.; manilla rope, Sclater Asbestos Mfg. Co; coal oil, Rogers, Robertson & Co., castor oil, Henry Dobell & Co; boiled linseed oil and white lead in oil, McArthur, Corneil & Co., turpentine and oxide of iron in oil, Canada Paint Co; iron castings, Wm Rodden & Co.; steam coal, Kingman, Brown & Co.; the tender for files was left for award by discretion of chief engineer after a trial of the goods offered. The board have granted two berths of 400 feet each to Elder, Dempster & Co., just below the Donaldson Line, for their Avonmouth & London lines, and one berth on the west side of Victoria pier for the Columbia and Head lines of steamers.

Electric Flashes.

THE Brantford Street Railway Company are putting two new engines into their power house.

THE Milton, Ont., Electric Light and Power Co., capital stock $15,000, is applying for incorporation.

THE Winnipeg Street Railway Company have put out a contract for a 600 h.p. direct-connected railway generator.

VICTORIA, B.C., Electric Light Co.'s works were seriously damaged by fire three or four weeks ago. Loss between $15,000 and $20,000

D. C. DEWAR has been appointed manager of the Bell Telephone Co.'s exchange in Ottawa, in place of T. Ahearn, who resigned recently.

HESPELER, Ont., electrical light plant has been purchased by Mr. Skinner. He has not yet decided whether to run it in Hespeler or to remove it altogether.

SUPT. FOLGER, of the Kingston, Portsmouth & Cataraqui Electric Street Railway, has received several applications from girls wanting to be appointed as conductors on that line.

THE Kingston, Portsmouth & Cataraqui Electric Railway are having built for them two open cars with double trucks for summer traffic, each with accommodation for 150 passengers.

THE Park avenue branch of the Montreal Street Railway will be extended through Montreal Annex to Van Horne avenue this spring, and will be in operation probably by the Queen's Birthday.

THE Guelph, Ont., Light & Power Co. held their annual meeting a short time ago, and the reports were received with satisfaction. Mr. Guthrie, president, and the old board of directors, were re-elected.

THE Berlin Gas & Electric Light Co. have been awarded the contract, for a term of five years, for supplying electric power for the street railway system which is to be installed at Guelph, Ont., this spring.

THE Toronto Street Railway Company has taken over the Scarboro' Railway, and it will be run hereafter as part of the city system. The stockholders of the Scarboro' road will get Toronto Railway shares for their holdings.

J. H. BEEMER has now fully decided to construct an electric railway throughout the city of Quebec and extending to La Bonne, St. Anne In connection with the scheme, a large hotel and park will be established at Montmorency Falls.

THE Hubbell Primary Battery Co., Ottawa, have elected officers: President, D. Henderson; vice-president, F. C. Sparks; secretary-treasurer, E. F. Hubbell. Satisfactory tests on the battery have been made, and its manufacture will be proceeded with as soon as possible.

THE Ottawa Electric Street Railway have decided on the extensions to their system which are to be carried out this year. They will shortly start work at the corner of Charlotte street, and proceed thence, *via* Daly avenue and Wurtemburg street, to Rideau. The Ann street line will be continued to Bell street. The time for the construction of the Preston street line has been extended for a year

THE Aerial Tramway Company, through its attorney, George W. Pound, who is also one of the directors, is applying to the State Legislature of New York for a charter for a scheme to build a cable tramway over the brink of Niagara cataract. A double set of cables will be stretched from the towers in the Canadian and American parks, with a supporting tower on Goat Island. On these cables cage-like cars will be suspended by trolleys and operated by electricity from the American side. The aerial line will follow along the brink of the American Falls to Goat Island, and thence to the Canadian shore, forming a chord to the bow of the Horse Shoe Falls. The cars will be of steel. The floors of the cars will be perforated to allow visitors to look below, and the side views will also be unobstructed. If the bill just sent to the New York Legislature becomes a law, expert engineers will be engaged to superintend the construction. The projectors claim that the aerial tramway line will be as safe as the suspension bridges. Each cable will be independent of the other, and sufficient to sustain ten times the weight of the cars and passengers. The electrical engineer will be able to stop and start the car anywhere on the line. A charter has been obtained on the Canadian side. The scheme is likely to be a profitable one, though costly.

Two new huge water wheels are being made for the Ottawa electric power house.

THE Avenue Road extension of the Toronto Street Railway will be constructed this spring.

C. B. POWELL, on behalf of an Ottawa syndicate, is endeavoring to secure an electric railway charter in the Island of Jamaica.

ROUT. BUSTIN, of St. John, N.B., has formed a company to put in the market a street railway car fender which he has invented.

RESIDENTS of Burlington Beach, Hamilton, are going to oppose any legislation for the construction of electric railways over the Beach.

THE Controller of Customs has decided that electricity comes under the head of unenumerated articles, and must pay a duty of 20 per cent.

THE W. A. Freeman Co., Hamilton, are applying for incorporation with a capital stock of $40,000, for the purpose of manufacturing agricultural fertilizers.

THE Ontario Government intend to introduce during the session a General Electric Railway Act, under which all proposed roads will have to be operated.

E. A. C. PEW, of the Erie aqueduct scheme, says that a large portion of the electrical energy obtained will be used for heating purposes in the city of Hamilton.

THE Robb Engineering Co., Amherst, N.S., have shipped a Monarch Economic boiler and Robb-Armstrong engine to the electric light station in Dartmouth, N.S.

WORK is being resumed on the Montreal Street Railway building which partially collapsed some weeks ago, and the company expect to take possession about November 1st.

THE London and Western Ontario Electric Railway Co.'s application to be incorporated has been passed in due form to the Private Bills Committee of the Ontario Legislature.

THE St. John, N.B., Electric Railway Co. will begin operations on the Bay street route as soon as the weather permits. Tracks will probably be laid on the cemetery route before the fall.

THE Inland Revenue Department have just approved a new stamp to be used in receipts for payment of electric light inspection fees. The stamps will be of the following denominations: 25 and 50 cents, $1, $2, $3, $5 and $10.

THE Welland Electric Light Co. are putting in steam power to supplement their water power. An improved and altogether reliable electric light system is looked for. The company's buildings will be extended in order to accommodate the enlarged plant.

THE petitions against any further extensions of time for the Kingston and Smith's Falls Railway Company in which to build the road between Kingston and Ottawa, are being largely signed. An effort will be made to revoke the bonus and apply the money towards the employment of people.—*Whig.*

WINNIPEG city council is asking the Legislature for power to enable the city to construct and operate a plant for the production of gas for illuminating and heating purposes, and in connection with this to establish a plant for electric street and house lighting. It is claimed, however, that the existing gas company has a monopoly until March, 1898.

THE Hamilton Radial Electric Railway are asking for changes in their charter whereby the branches from Hamilton to Guelph, to Mount Forest and Berlin, may be operated either by steam or electricity, or by both, and whereby their bonding powers may be increased from $20,000 to $30,000 per mile on these branches, in order to provide a better roadbed. Some surveying is now being done for this company around Hamilton.

THE Hamilton, Valley City and Waterloo Railway Co., if their application for incorporation is passed by the Legislature, as will probably be the case, will start the work of construction with as little delay as possible. One call has so far been made on the company's stock, and it was paid with gratifying promptitude. Much of the surveying work has been already done. It is the intention, if possible, to have the road in operation before the end of the present year.

ST. LAURENT, Que., council have granted the Montreal Park and Island Railway Co. a thirty years' franchise for the establishment of an electric railway and lighting system, and also exemption from taxation for twenty-five years, and the exclusive right to erect poles and carry wires through the municipality. In addition to this, the whole right of way will be granted free. The municipality covers 5¼ square miles, and includes St. Laurent, Cartierville, Bord au Plouffe, Cote Virtue, Cote Liesse and Lower Cote des Neiges. The road is to be in operation before the end of next year.

JOHN CHILDERHOSE & SONS will probably establish an electric lighting plant at Eganville, Ont.

THE Richmond, Que., Electric Light Co. are going to replace all the semaphore signal lamps at the G.T.R. station at that place with electric lights, and the switches are all to be moved by electricity.

THE Halifax, N S., Street Railway bill provides that the company shall pay the city 4 per cent. on its gross earnings, and pay the old company $50,000, to be divided between the shareholders and landholders.

FRANCIS COTE, formerly with the Bell Telephone Company, and Abel Huot, have formed a partnership under the name of Huot & Cote, Montreal, and will establish electric plants throughout the Province of Quebec.

NICOLA TESLA, the "wizard of electricity," who was reported as being on the eve of important scientific discoveries, experienced a terribly severe loss in the burning last month of his workshop at New York His condition was bordering on nervous exhaustion before the fire, owing to overwork, and the consequences of the latter on the inventor's mind may perhaps be serious.

AT the last meeting of the Hamilton city council it was stated that there was a possibility of the amalgamation of the Hamilton Grimsby and Beamsville, the Hamilton and Dundas Street Railway, and the projected Hamilton, Valley City and Waterloo Electric Railway. In any event, it was the opinion of the aldermen that a mileage rate and a percentage on the gross receipts should be exacted from these roads.

Personal.

G. D. O'FARRELL has been appointed inspector of lights at Quebec

JOHN KELLY, of St John, has been appointed inspector of lights for New Brunswick.

J. H. HARDING, marine agent, and inspector of lights at St John, has been superannuated, and is succeeded by his son, F. J. Harding

J. W. TAYLOR, late manager of the Peterborough Carbon and Porcelain Co., has resigned, and has been appointed to a similar position in the Ottawa Carbon and Porcelain Co.

P. J. SLATTER, city and district passenger agent for the G.T.R in Toronto, died last month, and J. A. McKenzie, who occupies a similar position in Woodstock, will be appointed to the vacant position.

J. O THORN, manager of the Metallic Roofing Co., Toronto, has returned to Toronto after a two months' trip to Europe. Mr. Thorn reports business active in many lines of manufacturing in England.

FREDERIC NICHOLLS, of the Canadian General Electric Co., was elected first vice-president of the National Electric Light Association of the United States at the convention held in February at Cleveland, O.

The officers and members of the various branches of the C. A. S. E. will regret to learn of the accident which befel their executive secretary, James Devlin, of Kingston. Bro. Devlin, in jumping off an electric car the other day, fell and broke his leg. The mishap is all the more regrettable, as he had only lately got out from a bed of sickness.

Brief, but Interesting.

A SUBSIDY is being agitated for for the purpose of extending the Canada Eastern Railway to Hardwicke, N.B.

PROF. FLEMING, of the Royal Institution, London, Eng., believes that electricity is a wave motion of the ether of great rapidity similar to light, but with waves several yards in length instead of mere fractions, and that it would prove to be in this direction that the great discoveries of the future will be made.

ELECTRIC welding is now used to remedy blowholes in defective castings, by first drilling or chipping out the defects, and then heating the casting around in a gas or oil flame blast. Scraps of steel are then introduced, and the electric arc is applied to melt them. The result is a perfect joint, without seam or flaw of any kind.

TUBES of exceedingly light weight, but of great comparative strength, are now made from the best tool steel, a material that has hitherto not been drawn for this purpose, because of its excessive hardness

The Patent Review.

46,904 C. W Meggenhofen, Franklin, Ind., and A. S. Courtwright, Indianapolis, Ind., boring machine.
46,906 Wm Young, Priorsford, Scotland, process for producing gas for illumination.
46,910 J. J. Hamilton, Neepawa, Man., device for changing motion
46,912 E. Lloyd, Blue Island, Ill., balanced slide valve.
46,913 W. B. Hartridge, Balham, London, Eng., manufacture of fuel.
46,916 F. C. Blackwell, Enniskillen, Ont., apparatus for operating pumps in deep wells.
46,918 A. S. Petticrew, St. Louis, Mo., automatic receding sawmill set-works.
46,920 W. J. Copp, Hamilton, Ont., cooking stove.
46,930 J. L. Gregory, Washoe City, new fire escape.
46,934 T. Seaton, senr., Toronto, pipe bender.
46,937 W Thomson, Baron Kelvin of Largs, Glasgow, Scotland, electric meter.
46,939 S. Kimball, Montreal, fender for electric cars.
46,945 Florence L. Hartel, electro-magnetic switch.
46,949 Jas. Reginald Stocks and Richard Grundy, both of Toronto, automatic two-pole electric switch.
46,952 Thos Thatcher, Utica, N.Y., extension car step.
46,953 H. C. F. Stormey, Christiania, Sweden, treating salts in solution by electrolysis.
46,955 P. Manhes, Lyons, France, manufacture of cobalt and nickel.
46,956 J. A. Mays, Adamstead, London, Eng., centrifugal apparatus.
46,957 Cole Manufacturing Co., Laconia, N.H., friction clutch.
46,958 Pneumatic Tire Co., Dublin, Ireland, pneumatic tire and rim for wheels.
46,963 A. G. Campbell, Sherbrooke, Que., cutting mechanism for mowers, etc.
46,964 J. F. Davey, Marlboro', Mass., pegging machine.
45,967 J. F. Ross, Toronto, method of hermetically sealing metallic vessels.
46,969 Geo. Bélanger, Beauport, and Pierre Marie A. Genest, Quebec, cement.

METAL IMPORTS FROM GREAT BRITAIN.

The following are the values in pounds sterling of shipments of metals, etc., from Great Britain to Canada, as shown by the British Board of Trade returns for February, and for the period up till the end of February of last year:

	February.		Two months ended February.	
	1894.	1895.	1894.	1895.
Hardware and Cutlery	£ 4,647	£ 4,301	£11,214	£7,547
Pig iron	539	209	2,092	209
Bar, etc	1,092	989	3,057	2,291
Railroad	3,565	.....	7,017	.....
Hoops, sheets, etc	1,455	1,244	4,350	2,865
Galvanized sheets	2,254	1,377	4,210	2,872
Tin plates	12,188	5,357	30,327	15,946
Cast, wrought, etc., iron	3,152	1,482	8,487	3,478
Old (for re-manufacture)	365	.....	1,098	.....
Steel	5,075	3,117	13,318	5,650
Lead	93	502	333	872
Tin, unwrought	1,117	904	2,867	3,760
Cement	.....	.....	1,238	30