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The Canadian Engineer

VOL. VI.—No. 7. TORONTO AND MONTREAL, NOVEMBER, 1898. PRICE, 10 CENTS $1.00 PER YEAR.

The Canadian Engineer.

ISSUED MONTHLY IN THE INTERESTS OF THE
CIVIL, MECHANICAL, ELECTRICAL, LOCOMOTIVE, STATIONARY, MARINE, MINING AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

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

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

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

Toronto Telephone, 1892. Montreal Telephone, 2589.

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

CONTENTS OF THIS NUMBER:

THE TORONTO MAGNETIC OBSERVATORY.

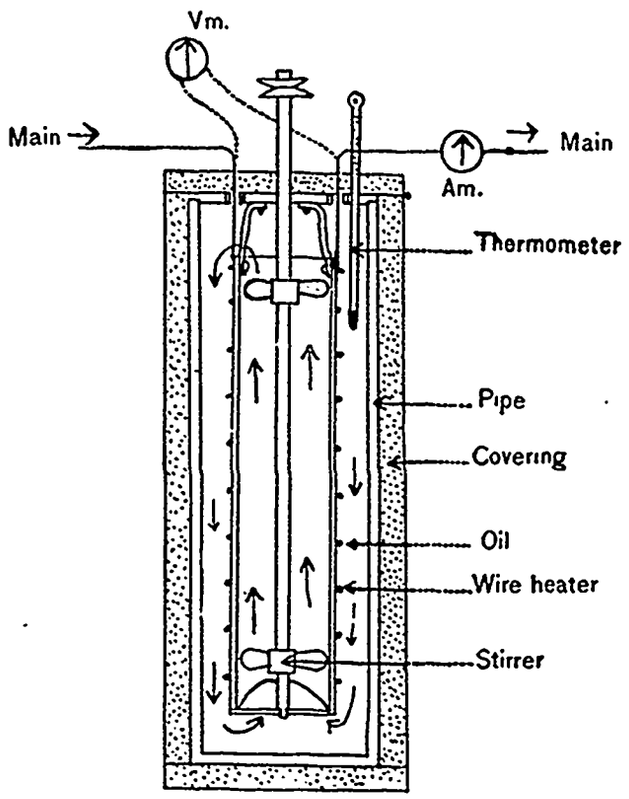
In the February number of THE CANADIAN ENGINEER was given a brief history of the Toronto Magnetic Observatory and of the troubles that have resulted from the erection of buildings in an all too close proximity to the Observatory, later by various city electrical installations and still more recently by the Toronto electric railway system. In an interview with the Honorable the Minister of Marine and Fisheries in February, 1897, the director of the Observatory suggested that before deciding finally on a removal of the magnetic instruments to another site and breaking one of the longest series of magnetic records outside of Europe, it would be well to invite an expression of opinion from one of the most celebrated magneticians of Europe, several of whom were to be present at the meeting of the British Association for the Advancement of Science in the following August. The Minister was pleased to approve of the suggestion and on the arrival of members of the association the director wrote to the various members of the Kew Committee of the Royal Society who were in Toronto, and also to Dr. Van Ryckevorsel, of Holland, and Professor F. H. Bigelow, of Washington, U.S., requesting the favor of their presence at the Observatory to inspect the photographic magnetic curves there obtained with the view of expressing an opinion as to the advisability of continuing the records at the present site or of removal to some point distant from electric tramways. Prof. Rucker, F.R.S., Prof. Carey Foster, F.R.S., Prof. Fitzgerald, F.R.S., Dr. Van Ryckevorsel and Prof. Frank Bigelow are the gentlemen who courteously accepted the invitation and were pleased to sign a statement that in their opinion the value of the magnetic observations at Toronto had been seriously impaired by the trolley system and advising removal to some other site. Later on, Professor Rucker, speaking at the Massey Hall, stated that Toronto's magnificent electric tramway system had ruined the Observatory. As it was feared that the public on hearing such an expression from the learned members of the association and not recognizing the difference between the Toronto Magnetic Observatory and the central office of the Dominion Meteorological Service, might imagine that a site suitable for the one would be unsuitable for the other, Professor Rucker wrote a letter to the effect that the statements made regarding the Toronto Observatory had reference to the magnetic observations only and had none whatever to the meteorological work there performed. It became evident then that the opinion held by gentlemen engaged in corresponding scientific work abroad, was quite in accord with that of the Director of the Observatory, and shortly after the close of the meeting of the B.A.A.S. he was authorized by the Government to choose and purchase a suitable site for a new magnetic observatory, and after making careful examination as to the distance that the electric currents might effect the magnets, it was decided to erect the new building near the village of Agincourt, a point about 10 miles distant from the present Observatory, easily accessible by railway, and yet very unlikely to be invaded by the trolley system.

The new Observatory, which was commenced in June and finished during the early days of September, consists of two parts, first, a circular stone cellar 19 feet in diameter, the walls two feet in thickness, the floor concrete and the roof covered with felt and gravel, in which, on stone piers sunk in concrete to a depth of six feet below the floor, are placed the self-recording photographic instruments, namely, the declinometer for recording changes in the direction of the magnetic needle, and the bifilar and vertical force instruments for registering respectively changes in the horizontal and vertical components on the earth's magnetism. Above ground and connected with the cellar by a flight of steps is an erection which is divided into two portions, in the larger of which absolute magnetic determinations will be made, piers being provided on which to place the necessary instruments, and an adjustable opening on the roof for transit work, and the smaller an office which will be heated by a copper stove. Observations were first made in the new building on September 16th, and it was hoped that by October 1st all the instruments will have been adjusted in their new position and everything running smoothly. Results already obtained have shown that values will differ but slightly from those obtained at the old Observatory, and it is proposed to make a very careful comparison before dismounting the old eye reading instruments in Toronto. Very great care has been taken in selecting material for the building, every stone used was tested for magnetic effect and none but copper or zinc nails and fastenings have been used. There appears to be every prospect that the new Observa-

tory will be admirably suited for the purpose for which it has been designed, and there is strong reason to think that the series of observations at Agincourt will be practically a continuation of the old and valuable series of observations in Toronto. All the photographic records will be sent for development to the central office of the Dominion Meteorological Service.

THE PROTECTION OF STEAM HEATED SURFACES.

An interesting investigation has recently been carried on at the request of Edward Atkinson, having for its first object the discovery of the relative efficiency of several kinds of steam-pipe covering, and second to ascertain the fire risk attained upon this and certain methods and materials for insulation of steam-pipes. An attempt was made to show the gain in economy attendant on the increase and thickness of covering, and to show the exact financial returns which may be expected from the given outlay for covering steam pipes. Charles L. Norton made the experiments during a large part of the years 1896 and 1897, and considerable information is given in the report of these investigations on many minor matters and conditions affecting the transfer of heat from the steam pipe to the surrounding air. In reproducing some of the conclusions reached, as a result of Mr. Norton's experiments, we omit results of the tests of insulating materials, as they are not of great interest to Canadian steam users, but the report of the methods employed, as described in the Technology Quarterly, is given in full.



PLAN OF APPARATUS FOR TESTING STEAM PIPE COVERINGS.

The method adopted is one which, so far as is known, is original. A piece of steam pipe is heated from the inside by electricity. The amount of electrical energy supplied is measured, and hence the amount of heat furnished is known. If the steam pipe is kept at a constant temperature by a given amount of heat, it is because that amount is just equal to the heat it is losing, for if the supply were not equal to the loss, the temperature would rise or fall. In other words, the heat put into the pipe is just equal to the heat lost from it by radiation, convection and conjunction. By measuring the electrical energy supplied, the heat put in can be determined, and hence also the heat taken out or lost. It must be borne in mind that a given amount of electrical energy always produces the same definite amount of heat, the amount of heat furnished by one electrical unit of energy being known with greater accuracy than the amount of heat given out by a pound of steam in condensing.

The apparatus for making tests by this method comprises several pieces of steam pipe of different diameters and lengths, heated electrically within by means of coils of wire in oil. The oil is stirred vigorously and serves as a very efficient carrier to heat from the wires to the pipes. A brief description of the smallest tester may make the details of the apparatus more easily understood. A section is shown in the figure.

A piece of 4-inch steam pipe, 18 inches long, is closed at one end by a plate welding in, and at the other end by a tightly fitting cover. This pipe is then filled with cylinder oil, and a coil of wire of sufficient carrying capacity, and a stirrer are introduced into the coil. A thermometer is inserted in such a position as to record the temperature of the oil. An ammeter and voltmeter or a wattmeter may then be connected so as to record the amount of electrical energy supplied. The stirring must be brisk, and if enough power is put into the stirrer, to be comparable with the electrical energy supplied, such amount must of course be added, as it also is converted into heat. The apparatus is suspended in the middle of the room on non-conducting cords, and the thermometer read with a telescope, so that no heat from the person of the observer may be added to the supply given to the cover from within, and also that care may be taken not to produce air currents by walking near the apparatus during a test.

In making a test the following operations are carried out, and observations are taken in the following order:

The current is turned on, and heat is generated in the wire coil until the wire, oil and steam pipe have reached the desired temperature at which it is proposed to test. The current is then gradually diminished, until it is found to be of just the amount necessary to keep the pipe at this temperature without a rise or fall of one-tenth of a degree in 30 minutes. A reading of the voltage and current is now taken at intervals of 30 seconds, and the Watts and B.T.U. are computed from their average. We then have the number of B.T.U. lost from the outside of this particular pipe at this particular temperature. If, now, there is placed a steam-pipe cover around the pipe, it is found that a less amount of energy is sufficient to keep it at the required temperature, the difference being the amount of heat saved by the covering. The minimum length of time considered sufficient for equalization of heat, or "soaking in," to the cover, is 6 hours. If, after a second heating of 6 hours, no change in the conducting power is noted, the cover is considered in a permanent condition, and is tested. Some covers, notably those composed wholly or in part of wool, cannot be considered dry and constant until after an exposure upon a pipe at 200 pounds pressure for 6 or 8 days. Covers containing sulphite of lime are also slow in drying.

The three thermometers used were frequently standardized in naphthaline, and were examined to note any

disagreement among themselves. All tests were made at a temperature corresponding to 200 pounds steam pressure.

A comparative test was made in 1895, upon a number of steam-pipe covers on a 4-inch tester, 16 inches long. The results obtained have been published in the circulars issued by the Boston Manufacturers' Mutual Fire Insurance Company, and by the Steam Users' Association. The values given were stated to be purely relative, the specimen being too small to give reliable data on the absolute conduction, and the surrounding conditions not being controlled other than to maintain them constant during the several runs. The ends of the specimen were covered by massive heads, and the whole tester was situated within a few inches of brick wall and a stone pier. It was said that the heat loss was probably high, and while the exposure may have been such as to make it so, being a rather harsh test, yet one which was rigidly uniform in its requirements of the several covers. In short, the actual loss of heat per square foot of the pipe surface was correct for that particular piece, under the conditions of the test, but was not sufficient for the estimation of the actual saving which might be expected from the general use of coverings. It was deemed wise, therefore, to construct new heaters, 4 and 10 inches in diameter, and 36 inches long. These were suspended by non-conducting cords in the centre of the laboratory, so as to hang freely and not be in contact with any conducting supports. Conduction up to the lead wires and stirring rod was found to be negligible.

This seems to have approached more nearly the conditions of actual practice than can be obtained by any other method of testing, except the actual use of a long run of pipe, and the determination of the amount of heat put into such a pipe by the "condensation" method, offers many difficulties, and is open to much uncertainty. Therefore, in adopting this method, a reasonable exposure of the pipe is used, and there is an exceptionally good opportunity to measure the heat supplied.

THE INFLUENCE OF PAVEMENTS ON PUBLIC HEALTH.*

BY A. W. CAMPBELL, C.E., PROVINCIAL ROAD COMMISSIONER FOR ONTARIO.

In presenting to this association a paper on the sanitary aspect of pavements, I have been actuated by a desire to obtain information, rather than to impart it. Ontario has so recently developed from a wilderness into the home of civilization and culture; our villages have grown so quickly into towns, our towns into cities, and the advance of the various sciences has been so rapid, that our people scarcely realize the changed circumstances and the need of carefully directing their energies in meeting the demands of the times. In my visits to different parts of the province I am constantly met with evidences of the good wrought by this association. I find that in very small villages even inefficient drainage, cess-pools, piggeries, slaughter-houses, and impure water supplies are not now tolerated as they were once, and that this is due to the work of your association. It is with considerable hope, therefore, that I have undertaken to briefly lay before you the subject of pavements and public health, confident that you will lend your assistance in aiding our knowledge of this as of other matters pertaining to perfect sanitation; and that where reform is needed your aid will be afforded.

*A paper read before the Association of Medical Health Officers of Ontario.

There is no one paving material which possesses every quality desired in a pavement to meet all conditions and uses. The ideal pavement remains to be discovered; but the features which should belong to such an ideal pavement are so numerous and of such varying character as to render the search apparently a hopeless one. The ideal pavement: 1, should be cheap and economical of maintenance; 2, should be durable; 3, should suit all classes of traffic; 4, should offer little resistance to traction; 5, should give a good foot-hold to horses; 6, should be adapted to all grades; 7, should have a good appearance; 8, should not be muddy nor pervious to water; 9, should be sanitary, that is, non-absorbent, not subject to decay, easily cleaned, not dusty, not noisy.

It is apparent then that, notwithstanding the importance of the sanitary aspect of a pavement, there are other features which must be considered. The primary intention of a pavement is to accommodate travel, and to provide one which will do this satisfactorily, which will be durable, cheap, of good appearance, healthful, and possess in the highest degree the other qualities enumerated, in view of the location, nature and extent of traffic, is the problem which presents itself to the paving engineer. Just as no absolutely perfect paving for every time and place has been discovered, it is doubtful if any paving material now used should be utterly condemned. Each has its place in which, until the ideal universal pavement is found, it will be more satisfactory than any other which could be used under that particular set of circumstances of soil, climate, traffic, etc. The purpose of this paper, however, is to treat of the healthfulness of paving in general, of the sanitary aspect of commonly used paving materials; that is, asphalt, stone blocks, vitrified brick, cedar block, and broken stone (macadam), with respect to absorption, decay, ease of cleaning, dustiness and noise.

Of all these, cedar block has received the greatest censure on the score of unhealthiness. Dr. O. W. Wright, a health officer of Detroit, is quoted as saying: "On sanitary grounds I must earnestly protest against the use of wooden block pavements. Such blocks, laid endwise, not only absorb water which dissolves out the albuminoid matter that acts as a putrefactive leaven, but also absorbs an infusion of horse-manure and a great quantity of horse-urine dropped on the street. The lower end of the blocks, resting on boards, clay or sand, soon becomes covered with a fungoid growth thoroughly saturated with albuminous extract and the excreta of animals in a liquid, putrescible form. These wooden pavements undergo a decomposition in the warm season, and add to the unwholesomeness of the city. The street, in fact, might as well be covered a foot deep with rotting barnyard manure so far as unwholesomeness is concerned. Moreover, the interstices between the blocks and the perforations of decay allow the foul liquids of the surface to flow through, supersaturating the earth beneath, and constantly adding to the putrefying mass." Cedar block has been condemned in similar terms by many others. On the other hand, Col. Heywood, Engineer of the city of London, England, has said: "It has been said that wood pavements at all times smell offensively and may be unhealthy; but although some city streets have been paved with wood for thirty years, no complaints that I am aware of have been made to the commission on this head, and the inhabitants at all times have not only expressed great anxiety lest the wood should be replaced by other materials, but have subscribed towards the cost of its renewal. . . . I have at times noticed offensive emanations from it near cab-stands, but am unable to find further evidence of its unhea thiness. These remarks must be

held to apply only to public streets open to the sun and air, and traffic; in confined places and under some conditions, wood might be objectionable. I have seen it decaying in confined places without traffic."

The one statement by the Medical Health Officer of Detroit refers directly to the cedar-block pavement as we understand it in this country. The other opinion, that of Col. Heywood of London, is expressed regarding the wooden pavement as laid in European countries. Between these two pavements there is a vast difference. Under European practice, many of the pavements are of the Karri and Jarrah woods of Australia which are thoroughly saturated with resins, are very hard and are not subject to decay. They are sawn into brick like blocks and laid on concrete. Where soft woods are used, they are also cut into regular oblong blocks and laid on concrete; and are saturated with creosote or treated with some other preservative process. Wooden pavements of America, however, represented by cedar-block, are of a very different order. The round blocks, of irregular diameter, are merely the untreated wood, still carrying the bark. These, placed on a bed of sand, are under the most favorable conditions possible for decay, being constantly exposed to moisture, air and warmth. With no preservative treatment they are enabled to absorb to the fullest extent all forms of liquid street filth which, in the process of putrefaction, feeds on the organic matter of the wood. The surface, which quickly becomes uneven, retains a large quantity of loose matter subject to decay, the whole giving rise at times to noxious odors. The effect, were sufficient of such paving used, would subject us to the conditions favorable to marsh fever. From a sanitary standpoint the cedar-block pavement of this country would indicate a serious menace to health. At the same time, while we are justified as a matter of theory in arriving at this result, there do not appear to be any statistics to prove the conclusion to be a correct one. The death-rate of cities most largely paved with cedar-block does not bear any ratio to the extent of such pavement; nor does a change from cedar-block to another less absorbent pavement produce a noticeable effect on the death-rate.

In European practice, wood more suited to a business street than macadam, affording a better foot-hold for horses than asphalt, less noisy than granite setts, is exceedingly popular in spite of its less sanitary character. In this country, however, there is an unwillingness to renew a wooden pavement when decay has rendered it unfit for further use, and this, coupled with the less careful method of laying, is the cause of the complete disrepute into which it has fallen. Experiments have been made recently by a Polish scientist with regard to cedar-block. The bacteriological examinations showed that, in specimens taken from blocks which had been in use for four years, and from a depth of one centimeter and two centimeters below the surface, there were at the end of five days 650,000, 220,000, and 12,100 bacteria per gramme of wood. A later examination showed 1,200,000 colonies per gramme in the surface of the wood, and 8,600 colonies per gramme at two centimeters below the surface. An estimate, in terms of its nitrogen, was made of the organic matter absorbed by the wood, and indicated that the surface layer of wood contains more nitrogen than the most polluted soil. A comparative estimate of the pollution of the atmosphere was made by placing a definite quantity of sulphuric acid under a glass bell, on the surface of wooden and asphalt pavements, the result, as indicated by the quantity of ammonia absorbed by the acid, being much in favor of asphalt. The observations show that while a wooden pavement gives absolute protection to the soil and to the subsoil water, there was considerable atmosphere contamination. The experiments were made on blocks of pine, preserved by impregnation with copper sulphate. Such being the case with a wooden pavement laid under European practice, there can be little doubt of the unwholesome effect of cedar-block upon the atmosphere. Further experiments of this description, conducted by members of your association, would doubtless prove instructive and profitable.

Broken stone or macadam would next arouse suspicion with regard to its absorptive qualities. There is this great difference between the two, however, that whereas a wooden pavement itself decays and affords food for the decay of other organic matter falling on it, the macadam does not in itself decay. With under-drainage such as well-built macadam roads possess, it should be little more than a good sewage disposal bed for the comparatively small amount of sewage which falls upon it. A macadam pavement can be scraped and swept, it is not noisy, dust can be subdued by sprinkling, and on sanitary grounds appears to be an excellent pavement for residential streets where traffic is not excessive. For business streets, or for heavily traveled thoroughfares of cities, a harder surface is advisable.

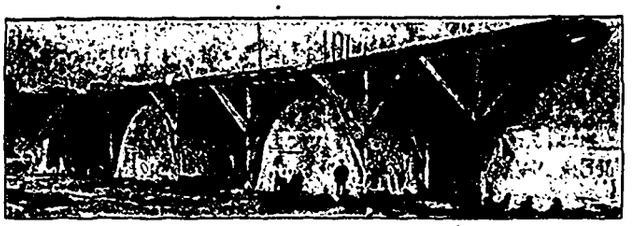
With regard to absorption, there can be no objection to asphalt, vitrified bricks nor stone blocks. Asphalt is impervious to water; while the joints of brick or stone pavements are practically perfect so far as absorption is concerned. To be sanitary a pavement should not be dusty. The dust of a pavement is not only an irritant, but carries with it the bacteria of disease which, from various sources, are a part of street filth. To prevent dust the pavement must be so perfectly cleaned that a practically harmless amount is taken up by the wind; or if perfect cleanliness is not possible, dust must be subdued by sprinkling. Unless perfectly cleaned, much more perfectly cleaned than is commonly the case in this country, an asphalt pavement is very apt to be a disagreeably dusty pavement on a windy day in summer. This, indeed, is one of its greatest faults from a sanitary standpoint. Toronto has the reputation of being a clean city, with a well-organized street department, yet even under these favorable conditions, a walk or drive down Yonge street on a warm, windy day is a very trying experience. The smooth, hot surface quickly dries any matter falling upon it, a wheel passing over this dry substance grinds it to powder, and the result is that clouds of dust find their way into the eyes, nose, mouth, throat and lungs of pedestrians. Business men in their offices are not safe from its attack, as it drifts in through the open windows. The dust imbeds itself in clothing, fastens itself on articles of food exposed in the shops, to be eaten finally by the purchaser. One case came to my notice in which a consumptive patient was ordered by his physician to leave Jarvis street, one of the best residence streets of Toronto, because of the dust which came from the asphalted roadway. These streets are swept by machines, and are hand-swept by a corps of city employees, but are not to my knowledge flushed as are similar pavements in London and Paris. Flushing is the only method whereby asphalt can be freed from this unsanitary dustiness, but in addition to being expensive and hurtful to the asphalt, such a proposal will doubtless meet the disapprobation of the engineer in charge of sewers. The dust, however, is not a defect of the pavement so much as it is a fault in the method of cleaning. Asphalt has, nevertheless, the disadvantage of being a very hot pavement. Its smooth surface, reflecting back

the heat and light, is productive at times of sun-stroke, and the glare is frequently painful to the eyes. This is most noticeable in closely built business sections where there is least circulation of air, where the sun beats down between high brick walls; and is not so objectionable on a shady residential street with houses well apart. Vitrified brick and stone block pavements are neither so dusty nor hot as asphalt since the surfaces are less smooth and assist in retaining in the joints the finer particles of dust. Sprinkling, too, is in a greater measure effective in subduing dust on brick or stone block than on asphalt, from the hot, smooth surface of which moisture evaporates rapidly. A macadam pavement is dusty if not properly treated, but it scraped and swept as are other pavements, the dust can be largely subdued by sprinkling. Noisiness, if excessive, is another unsanitary feature. A noisy pavement is jarring to the nerves, grating upon the sensibilities, and for either a heavily traveled business street, or a residential quarter, a quiet pavement is much to be desired. Noise itself is not always unhealthy. It is doubtful if the workman in a boiler factory, or a railroad engineer or other employee, is much influenced by the noise incidental to his occupation. Both are muscular of body, constantly taking vigorous exercise. But to the more sedentary man of business, whether at high nervous tension in his office or resting in the quiet of his home, a din, constant or intermittent, is a source of annoyance, and as such, is wearing on the nervous system. The most objectionable in this regard is granite or other stone block pavement. Vitrified brick is apt, unless great precautions are taken, to create a disagreeable rumbling. Asphalt, wood and macadam are the least objectionable with respect to noise.

While we have this to say of the comparative healthfulness of different varieties of pavements, there is another condition of matters common to too many towns and cities, in which the streets in fall and spring form a wilderness of mud and stagnant pools, and in summer are shapeless beds of dust. Many of them are made the receptacles of the refuse from private property, which is left to disfigure the street, forming rivers of filth and cess-pools of disease. Such streets have been regarded as a zero quantity, doing no particular harm, doing no particular good. Streets, however, which do no good, should do good, and therein lies the harm. A good street is a well-drained street, a well-cleaned street, and is a source of healthfulness to the members of the community. Streets should be the public parks, pleasing to the cultivated taste, adding to the culture and refinement of the people, and enticing them to breath health and vigor, whether walking, bicycling, riding or driving. Passing along the city street we reach the country highway, which, as a means of permitting the people of the city to leave the congested portions and to reside in the less thickly populated suburbs, forms an important factor in securing public health.

WOOD CARBONIZATION.

In the destructive distillation of wood, that is, ordinary charcoal burning, there are in the smoke or gas several valuable substances. These substances have been known for a long time and some have been partially recovered. The first process employed for the purpose was that for the production of tar from pine wood. Later, on the continent of Europe and in Scotland, wood was burned in retorts and the pyroligneous (that is crude acetic acid), was made into acetate of lime. Of late years, however, this business has had a very great development in the United States, where the large amount of excellent hardwood forests in the natural gas regions, where no wood is used for fuel, has given a very cheap raw material, making possible the export of acetate of lime and wood alcohol to Europe with profit.



THE CHARCOAL KILNS AT DESERONTO, ONT.

At present, there are two distinct processes used, called the kiln process and the retort process. In the kiln process the cord-wood is put into a large brick or stone "beehive" kiln and burned in the ordinary manner for producing charcoal, but the smoke or gases do not escape into the air, but are drawn through a chimney into a series of condensers, where all the liquid products are condensed out, and the gas is burned under the boilers. The liquor condensed (amounting to 180 gals. for a cord of well-seasoned dry wood), is led into tanks and the tar is separated out. This tar is redistilled, producing oils and pitch. If only wood alcohol is to be made, the settled liquor is distilled and crude alcohol produced and the residual pyroligneous acid is run to waste. If brown acetate of lime is to be made, the crude liquor is neutralized with lime before the alcohol is distilled off. If gray acetate of lime is to be produced, the crude liquor is all distilled and purified before neutralizing with lime. This method gives the best product, the gray acetate of lime containing from 82 per cent. to 86 per cent. of acetic acid, while the brown acetate of lime sometimes contains less than 60 per cent. of acid. The retort process differs from the kiln process of carbonizing in having the cord-wood put into horizontal wrought-iron cylinders, and these are heated by a fire-place beneath them. In the kiln process, enough air is let into the kiln to burn a portion of the wood, and this heat serves to carbonize the rest. The retort process is superior to the kiln process in giving larger yields of valuable products, but the cost of installation and of working is greater.

The by-products in the liquors from the condensers are recovered the same way, whether produced by the kiln or retort process. In all the processes the alcohol is re-distilled, purified and treated chemically, and brought up to a strength of 95 per cent., before being put on the market. The products of this industry are used in the arts for various purposes. Wood alcohol or methyl alcohol is like grain alcohol in many physical properties, but is poisonous. It is used for making spirit varnishes for burning and dissolving various gums, and by the government for making methylated spirit. Acetate of lime is used for the production of acetic acid, which is the acid of vinegar, and is diluted and flavored and sold for this purpose in Russia and other European countries.

The Standard Chemical Co., Limited, first introduced the retort system into Canada about a year and a half ago at Fenelon Falls, Ont. Previous to this, the only works in Canada turning out these wood products, were located at Deseronto, and owned by The Rathbun Co., which owned the patents for the Burrel

Kiln process. H. O. Chute, superintendent of the company, was employed by the Standard Chemical Co. to erect a retort plant at Fenelon Falls, which has been in operation since last fall. When the Deseronto Iron Co. decide to locate at Deseronto, assuring a market for the charcoal, the Standard Chemical Co. acquired the rights of the Burrel patent, owned by the Rathbun Co., and decided to enlarge the plant by putting in retorts. This plant will have the largest single bench of retorts in the world, and many new features of construction are being introduced, which allow of a more economical working and handling of all products by machinery. We are indebted to H. O. Chute, superintendent of the Standard Chemical Co., for the information contained in this article.

THE OTTAWA VALLEY CANAL.

The report of the special committee of the Dominion Senate, appointed to examine into the feasibility and advantages of a water-way connecting Lake Huron with the St. Lawrence, via the Ottawa river, has been published, and is accompanied by three maps of the proposed Montreal, Ottawa, and Georgian Bay Canal, including a plan and profile. The report as issued seems to be entirely in favor of the construction of the work. The witnesses examined, who included S. A. Thompson, Duluth, U S; Major-General Gascoigne, at the time Commander of the Canadian Militia; Marcus Smith, M. Inst. C.E., Ottawa; James Meldrum, M. Inst. C.E., London, Eng.; O. Higman, Dominion Electrician, Ottawa, and H. K. Wicksteed, C.E., Cobourg, Ont. A series of questions were also sent out to a large number of those who might be supposed to be either most familiar with the locality and the nature of the construction required in the particular work in question, or whose knowledge of like questions and of transportation generally gave their opinion weight with the committee. Replies were received, among others, from Sir Wm. Van Horne, Walter Shanley, C.E.; T. C. Clark, M. Inst. C.E., New York; Andrew Bell, C.E., Almonte, Ont., and R. W. Shepherd, Man. Dir. of the Ottawa River Navigation Co.

The bright side of the picture seems to have been presented to the Senate more fully than the reverse. There are several features of the proposed work which are not very fully dwelt on in the report. The estimates of the cost discussed were largely those proposed for a twelve-foot waterway, and the canal under discussion is to have a depth of fourteen feet. The report of T. C. Clark, M. Inst. C.E., made in 1860, is quoted, in which he says: "The distance is 430.76 miles, of this 351.81 miles are already a perfect natural navigation, and require no improvement, and it is perfectly practicable so to improve the remaining 78.95 miles as to convert the whole chain of water into a first-class navigation for steam vessels, and to reduce the length of canaling 29.32 miles, or exclusive of the Lachine Canal, to 20.82." In the late report he says: "To improve the navigation of such a river system is comparatively easy, for the greater part is already accomplished." Marcus Smith, M. Inst. C.E., in his evidence before the committee, says of the river stretch: "I think there is only one place in the Ottawa that we need to make any dredging at all for twelve feet, but there may be some more for fourteen feet." The evidence seems to point to the use of the Ottawa river as part of the canal in its present state, or when improved at a comparatively low cost. The witnesses, who were heard through their answers to the series of questions, had not the same opportunity to bring forward all the facts at their command as had those who were examined by the committee. Andrew Bell, C.E., is quoted in the report as speaking enthusiastically of the electrical possibilities of the water along the canal, but does not give any evidence as to the condition of the lower Ottawa. Mr. Bell was the engineer in charge of the construction of a government dam in the Ottawa river at Carillon, and is very well posted on the subject of the Ottawa river. In an article published in THE CANADIAN ENGINEER in August, 1897, Mr. Bell says: "At present not more than eight feet depth for navigation can be depended on between Lachine and Ottawa city, in low water." Some of the engineers giving evidence were in doubt as to nature of the bottom of the Ottawa. Mr. Bell made extensive surveys, 1870—1882, from above Grenville to below Carillon, and (by an assistant), above and below St. Ann, and he states that "the lower Ottawa flows over limestone rock." There appears then to be a very serious problem in adapting the present navigation of the Ottawa to the demands for increased depth. The report made by the Senate committee seems to show how incomplete is the information before the public, and how necessary it is that a careful examination of the whole place should be made, and preliminary surveys carried out before the government affords any assistance to the scheme, either by a money grant, or by lending its credit by a guarantee of interest per term of years, as has been proposed.

In a paper read before the Royal Society of Canada in 1893, T. C. Keefer, C.E., C.M.G., stated that: "The Ottawa route would be most valuable to Lakes Michigan and Superior ports, as affording much the shortest water route to tide-water at Montreal, and also at New York, via Lake Champlain, if the barge system of transportation proves to be the most efficient and economical. Hydraulic lifts, or pneumatic locks, may yet bring the shorter and shallower water routes into competition with the St. Lawrence; but as long as boats are kept in their native element, the broad deep channel of the St. Lawrence will remain the only one which can successfully compete with the railways."

FIRE-PROOF BUILDINGS.

BY FRANCIS C. MOORE.

(Concluded from last issue).

Well-holes should be avoided if the building is to be regarded as "fire-proof." It is almost impossible to control a fire starting in the lower floors where a well-hole opens through those above. Luxfer Prisms are now used to secure light from side windows, it is claimed, with great success. A recent fire test of the Luxfer Prism, in Chicago (March, 1898), is stated to have been satisfactory to Fire Marshal Swenie, as showing that these prisms afford material protection from the heat of a neighboring fire in an exposing building, and that, to some extent, they are substitutes for iron shutters. These should be in hallways cut off from the rooms at each story by fire walls and doors, to prevent draughts. It is not so important, and is not so practicable, in the case of office and hotel buildings as in the case of mercantile and manufacturing buildings; but it is advisable, even in office buildings, to have the staircases, elevators, etc., in a separate hallway, the division walls of which should extend through and above the roof, and any skylights should be covered with glass not less than ¼ inch thick. It is contended by some that skylights should be of thin glass, so that they will break easily and permit the escape of smoke and

gas. Smoke is inflammable, and when it accumulates in a building, often spreads the fire from story to story, or blows out the walls by the explosion of its gases. But while thm skylights are contended for by many expert firemen, it should be borne in mind that nothing so facilitates the spread of fire as a draught, and it would be better to have the skylights adjusted with appliances for opening them, so that when the firemen arrive on the ground, and not before, they may be adjusted to permit the escape of smoke and allow the firemen to enter the building to see where to work to the best advantage. Under any circumstances a network of wire should be above the glass to guard it against flying embers, and another should be suspended beneath the skylights, so that when the glass cracks and breaks with the heat it will not injure the firemen below.

Roofs should be of brick or tile on all high buildings, the roof beams being of iron and, where tanks are supported, of sufficient strength to carry many times the actual probable weight of the water and the containing tank itself. Slate roofs, on very high buildings especially, on street fronts are objectionable, as, in case of fire, the slates would crack and, falling to the street, injure the firemen. A flat roof of brick tile is better than any other. All water on roofs from rain or melting snow should be drained from the front or sides to leaders, so as to avoid drip points, from which icicles could be formed.

The electric light installation of a "fire-proof" building is an important and complicated matter. The switchboard should be of combustible material, and no steam, water, or sprinkler pipes should pass over or near it where, in case of a bursting pipe, water could reach the switchboard and cause disaster. This is an important matter almost universally overlooked. An admirable floor for a dynamo room is one of deck glass, ¾ inches thick, on a wooden (not iron) frame. It will insure that the attendant upon the dynamos will be, at all times, effectually insulated. Such a floor will not become soaked with oil, as would a wooden floor, and can easily be kept clean. A strip of rubber floor carpet stretched over it will prevent slipping.

It is sometimes necessary to have communications between adjoining buildings by doors in the fire walls, and it is not always convenient, for changing merchandise from one room to another, to have "fire-proof" doors closed during working hours. It is possible to have the "fire-proof" doors run upon trolleys on an inclined track, so as to close by the force of gravity and held open by fusible metal latches or links which would release them when melted by the rising temperature of a fire. It has occurred to me that this difficulty may also be met by erecting between two adjoining buildings a separating "fire proof" hallway of brick, which can be utilized for containing staircases and elevators, and for supporting the water tanks of automatic sprinklers. The doors which open into this hallway should not be opposite each other, but at opposite ends of it, so that fire in one of the buildings passing through the door would come against a blank wall opposite. Even if the "fire-proof" doors to these openings should happen to be open at the time of a fire in one of the two buildings, it is improbable that it would find access to the other. The floors should be both fire and water proof, slightly lower than those of the two separated buildings, and with water vents or "scuppers" for carrying off surplus water thrown by a fire department. Indeed, it is well to have "scuppers" on all floors of every building. The walls of this separating hallway should rise 4 feet higher than the roofs of the two buildings, and, if there are window or door openings near it, its walls should project beyond the line of enclosing walls at least 1 foot.

The water tank, as already stated, should be supported on protected iron I-beams, resting on the brick walls, with cast-iron templates, so that the tank cannot fall, break down the staircases and wreck the building in case of fire. It is important always to locate tanks so that they will not be over stairways or elevators, and endanger them in case the supports give way. With a "fire-proof" hallway of the kind recommended, containing no combustible material whatever, the tanks being supported by iron I-beams resting on the brick walls, this would not be an important matter, but in all other cases water tanks should be planned so as not to endanger staircases, and the supporting iron beams should be "fire-proofed," that is, covered with "fire-proof" material. It ought to be unnecessary to state that there should be no combustible material whatever in this separating hallway, and that the staircase, elevators, etc., should be of metal and "fire-proof." Indeed, such a hallway as this could be relied upon to separate wooden buildings. It should, however, for that purpose, be at least 10 feet higher than the peak of their roofs, and should extend 4 feet beyond their front and rear lines.

Where it is not necessary to transfer merchandise from one building to another, and only requisite to have a passageway for employees, this may be arranged by an iron balcony, like a fire escape, cutting down the window on each side of the separating wall for a door, so that communication can be had by the balcony. The openings should have "fire-proof" doors. This would be practically safe. It might, with iron ladders, be utilized as a fire escape, and so prove of great advantage to firemen in fighting a fire, who could hold a hose nozzle at the different windows with perfect safety to the last moment. It is practicable, indeed, to have iron stairways with roofed balconies entirely outside of storage stores so that the floors do not communicate. There are a number of these in Philadelphia.

These should not be of iron, but of wood covered with tin. Solid iron shutters or doors are not reliable. Iron doors yield readily to flame, resulting sometimes in their warping open when exposed to fire in an adjoining building, exposing the one they are intended to protect to the full effect of the flames. Where window openings are protected by iron shutters on rear courts they are almost certain to be opened by a fire in an exposing building, and cannot be relied upon. The tin covered wood shutters are alone reliable. There is no recorded instance in which a solid iron door, exposed to the full effect of fire in an adjoining building, has protected the opening, whereas there is, on the other hand, no recorded instance in which the "Underwriters'" door has failed to serve its purpose—two important facts which are significant and ought to settle the question. The "Underwriters'" door is constructed of ordinary white pine lumber, free from knots, of double or treble thickness, according to width of opening, the boards being nailed diagonally and covered with the best quality of tin, with lap-welded joints. It ought to be unnecessary to state that on the exposed side of a building, not only the shutter, but the window-frame, sash, etc., should be of metal or covered with metal—riveted, not soldered. Where it is not possible to use a "fire-proof" shutter for want of room, wire glass in a metal frame will be found a desirable substitute. It will probably hold a fire until the fire department can cope with it. It is not generally understood nor known that fire will travel from one story to others above by way of the windows in the outer or enclosing walls. Especially where a building has an enclosed court, it will sometimes reach upper stories in this way, even when the floors themselves are thoroughly cut off, the court acting as a chimney.

It may be well to suggest for the benefit of those who are not familiar with city fires that, as heat naturally ascends, the exposure of a low building is often much greater to a neighbor higher than itself than to a building of its own height, so that a tall, "fire-proof" structure, surrounded by smaller buildings, should be provided with fire shutters to all openings. These are not necessary where the exposing buildings are occupied for offices, and are themselves "fire-proof," as the amount of heat which escapes from the windows of a burning building, so long as its enclosing walls remain intact, is seldom sufficient to ignite a "fire-proof" building or its contents. The moment of greatest danger is when a burning building collapses, and the intense heat caused by its enormous bed of coals, exerts its full effect upon surrounding structures. In a recent fire in New York three "fire-proof" office buildings were more or less damaged with their contents, although many feet away from the burning building. It is to be hoped that some inventive genius will devise a plan for simultaneously opening or closing the shutters on any or all stories of high buildings by manipulation from the ground floor. They are usually left open at night, always in the day time, and might thus be closed in case of a dangerous fire in the vicinity. In some cases they are fastened open.

Tests of "fire-proof" material, iron beams, pillars, floor arches, etc., to be of any value must be conducted under circumstances which insure uniform conditions. Otherwise comparisons are unreliable. It is quite customary to refer to results of fires in different buildings, having differing forms of construction, as supporting theories of relative merit; but ordinary conflagrations cannot be relied upon, for the reason that in two buildings, side by side, the conditions may be widely different.

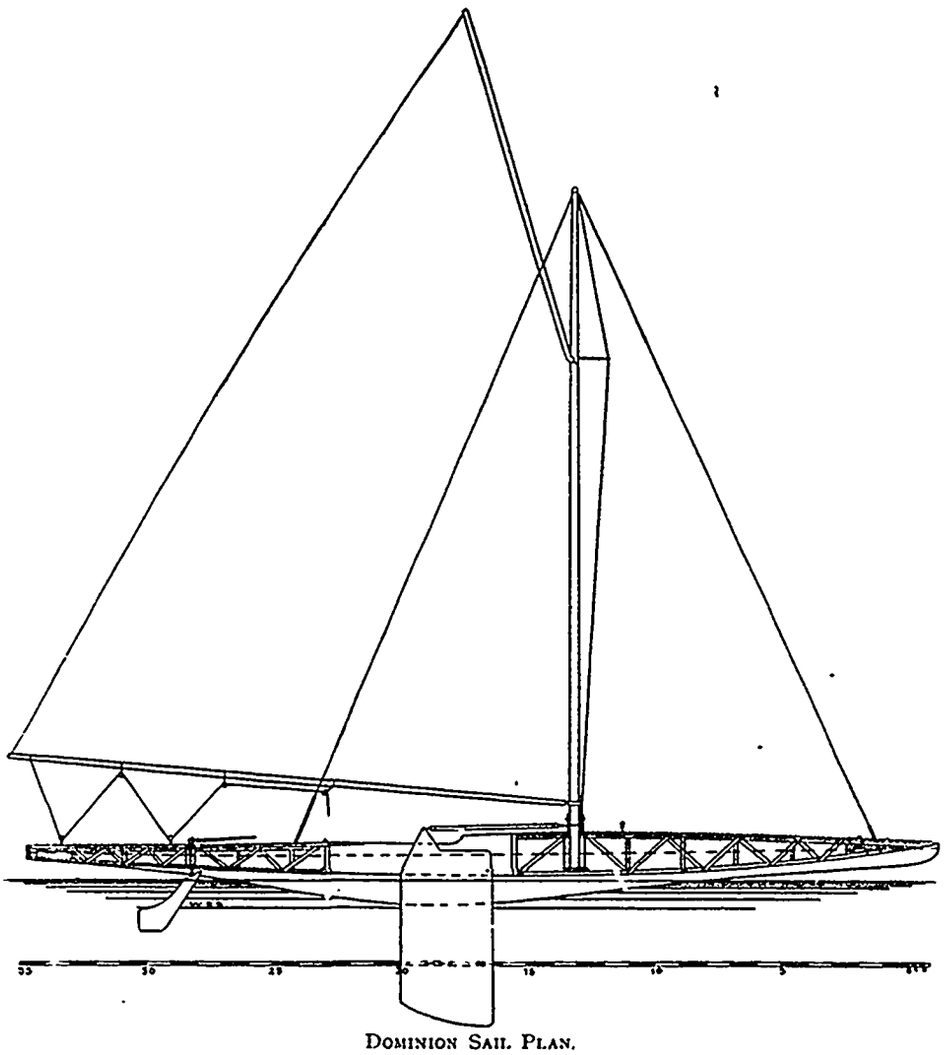
Eddies and currents of air, changes of prevailing wind, etc., may secure exemption from damage. It happened in the large conflagrations of Chicago, Troy, Boston, etc., that the most phenomenal escapes were observed. In some instances frame buildings, surrounded by brick structures which were totally destroyed, escaped with no further damage than the blistering of paint.

Even where tests are carefully arranged, especially weigh tests, obvious precautions are sometimes overlooked. It will be observed, for instance, where bricks are piled on a surface of floor arch and iron beams to secure a certain weight per square foot, the pile of bricks may be so disposed as to have a bearing on both of the iron beams, and the full weight may not come upon the "fire-proof" arch between them. The lateral bond of a pile of bricks a few courses higher than the floor to be tested may have all the effect of a relieving arch and materially reduce the strains. In furnaces constructed to secure high temperatures, drafts and currents of air should be provided for with great care and under the direction of the most competent and intelligent experts.

THE DOMINION.

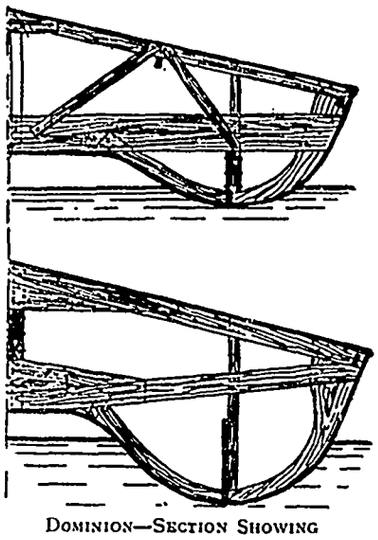
The 20-foot yacht Dominion, built to defend the Seawanhaka international challenge cup, upon the design of G. Herrick Duggan of the Dominion Bridge Co., Montreal, is a racing machine which has already aroused a lively discussion that is likely to result sooner or later in a radical revision of the rules governing the class, and possibly of the general rule governing all the smaller classes, says Forest and Stream, from whose pages we reproduce the accompanying plans. The situation at the present time seems to be that either this new type must be recognized as legitimate in all classes, or some material change of the rules must be made to bar the entire scow type to which she belongs. The dimensions of Dominion are: Length over all, 35 ft. 10 in.. l.w.l. 17 ft. 6 in.; beam, extreme, 7 ft. 7½ in., l.w.l. over all, 7 ft. 1½ in., l.w.l., one bilge, 2 ft. 5½ in.; draft, hull, 10 in., with board, 6 ft.; freeboard, 1 ft.; sheer, bow, 3 in., stern, none; displacement, 1750 lbs.; area midship section, total, 2.88 sq. ft.; sail area, 500 sq. ft.

In many details Dominion is no more remarkable than others of the 20-foot class produced within the past two years. The "barn door" deck plan has been seen on other boats. The notable departure that has aroused so much hostile criticism is the hollowing of the floor, so plainly shown in the body plan. The object of this is to perfect the form of the bilge when sailing (as all the boats of the class are sailed) at an extreme angle of heel, and with the entire weather side of the boat clear of the water. The rig and general fittings are much the same as in other of Mr. Duggan's boats, Speculator and Strathcona of this year, and Glencairn, Avoca, Glenowen and others of last year. The centreboard is built up of wood and sheet steel, weighing about 250 lbs., or about 150 lbs. less than in last year's boats; it is situated amidships, in the centre of the hull, as in the other boats. The rudder is of a different form from last year, very wide below, but is of the same construction, a light iron tube for stock, two sheet steel sides, and wood filling, making a strong and light piece of work. The rig is of the same length on the foot, and the centre of effort is at the same height as in Glencairn II., but the gaff is peaked up, making a higher rig. All of Mr. Duggan's sail plans this year show these same proportions, looking like Momo of last year. One of the peculiar features of Dominion is the shape of her deck. The boats of last year were distinguished by a great crown and a peculiar curve to the beams; this year, in Dominion, the curve has been abandoned, each side of the deck running up straight to a ridge in the centre, like the roof of a house. This plan gives a great depth where it is needed, above the highest part of the floor, and especially for the housing of the mast, it aids in the transverse trussing, and it gives a weather deck that



DOMINION SAIL PLAN.

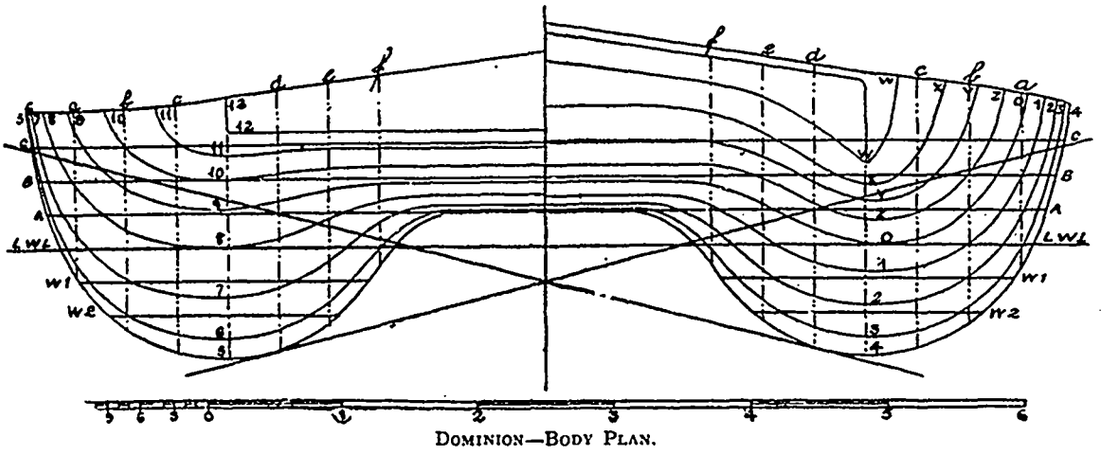
in sailing is flat and almost level. The cockpit is comparatively small, but it is carried down to the bottom, its floor being merely light strips laid on the floors. There are no bulkheads, the boat being open from end to end. The great length of the yacht, the large area of deck, the limited depth, due to the hollow under the floor, and the fact that only one side of the hull is water-borne at a time, with the absolute necessity for a



DOMINION—SECTION SHOWING CONSTRUCTION.

light hull, made the problem of construction a difficult one; but it was successfully solved by Mr. Duggan, who planned the entire construction and followed it closely during the building; the yacht being built at the shop of the Yacht Company of Canada, on the yacht club grounds at Dorval. So far as tested by the trial trips, practice sails, trial and cup races, the construction is a success in the important detail of strength, as the boat showed no signs of strain. One special point in favor of the construction is that only the cheapest and simplest materials were used, such as are found in any boat shop, and there was no call for special skill on the part of the workman.

The first point in the construction was to secure a sufficient depth of hull amidships, by means of a central ridge, giving depth for a fore and aft girder, and also stiffening the transverse trusses. The fore and aft trusses are located, one in the centre of each bilge and the third exactly between these two, in the centre of the hull. The lower member of each side truss is a vertical keelson of ⅝-in. white pine, 8 inches wide amidships; the posts are of white pine 1 by 1 inch, and the diagonals of the same wood 3 by ½ inch. There are transverse trusses spaced 2 ft. 2 in., forming the main and deck frame, also of ½-inch white pine, from 1¼ inch to 3 inches wide, the curved members being merely sawed off from straight stuff without regard to the grain. The members were carefully disposed and well fastened by numerous boat rivets. At the two after stations under the travelers, solid frames are used, and at the partners solid planks are used above the level of the middle floor. The skin is laid shiplap, of about three-eighths thickness, with three light bent frames between each of the trusses. The deck is also laid shiplap, just under three-eighth inches. The weakest point in boats of this class has been about the mast, there usually being no keel or keelson to carry the weight. In Dominion the mast step is suspended by four three-eighth inch steel bolts from two fore and aft pieces of oak, about 2 by 2 in., running over the top of the transverse trusses and transmitting the strain to several of them. In this way there is no direct strain on one point of the bottom. The construction, as a whole, is simple, cheap, homogeneous and apparently amply strong and durable. In these respects it compares favorably with that of the Crane boats, which was ingenious and carefully worked out, but at the same time calls for material unknown in boat shops and unfamiliar to the average boatbuilder, and depending for success on the use of metal in combination with wood instead of one material alone



DOMINION—BODY PLAN.

and many other features the present method involving a conversion of the mechanical energy of running water into electrical energy, and the transmission of the latter in the form of currents of very high tension to great distances. Provided therefore that we can avail ourselves of currents of sufficiently high tension, a waterfall affords us the most advantageous means of getting power from the sun sufficient for all our wants, and this recognition has impressed me strongly with the future importance of the water power, not so much of its commercial value, though it may be very great, but chiefly of its bearing upon our safety and welfare."

If Mr. Tesla's conclusion be correct, namely, that a waterfall affords us the most advantageous means of getting power from the sun for all our wants, excelling for this purpose not only muscular force, but wind and steam as well, the rocky uplands of northern and western Ontario may yet be reckoned

WATER POWERS OF ONTARIO.*

BY THOMAS W. GIBSON.

In speaking at Buffalo, N. Y., January 12th, 1897, on the occasion of the introduction into that city of electric power from Niagara Falls, Mr. Nikola Tesla, perhaps the most celebrated of living electricians, spoke of a tremendous problem yet to be solved in the production of power, to the elucidation of which he had devoted a great deal of attention. Without describing the nature of this problem, he spoke of it as an effort to "evolve means for obtaining energy from stores which are forever inexhaustible, to perfect methods which do not imply consumption and waste of any material whatever." Even if this stupendous achievement were accomplished however (as he had little doubt it would be), he said his investigations led him to conclude that "under the theoretically best conditions such a method of obtaining power cannot equal in economy, simplicity

*Extracted from the report of the Ontario Bureau of Mines, 1898. Vol. V Part III.

among the most valuable parts of the province by reason of the vast number of waterfalls situated there. The main watershed dividing the system of the great lakes from that of Hudson Bay runs in a northwesterly direction from the eastern boundary of the province north of lake Temiscamingue to the head of lake St. Joseph on the northern boundary, a distance of about 500 miles. It consists of a tableland or plateau rather than a sharply defined ridge, and is estimated to have an average width of about 70 miles, or an area of about 35,000 square miles, thus with the slopes on both sides affording an extensive catchment surface for the streams running to the north and south. Its elevation will average perhaps 1,400 or 1,500 feet above the level of the sea, or 900 feet above lakes Huron and Superior. In places it approaches the shore of the latter lake, and for the greater part of its extent is situated at a comparatively short distance from either of these bodies of water. The consequence is that the rivers and streams which flow from it into the great lakes, though mostly of considerable volume, are not of great length, and their descent is therefore usually rapid and abrupt, and marked in many places by cascades and falls.

The value of a river of given volume for purposes of water power does not altogether, or even chiefly, depend upon the amount of its fall from source to mouth. Of course the greater the fall the greater the energy possessed by the stream as a whole. But it is apparent that if the descent be gradual and uniform, or approximately so, there will be few places in its course where the fall is large enough to afford any considerable quantity of power. It is only where sudden falls or rapids occur, which create a decided difference in the level of the water, that the energy of the river is concentrated, as it were, within a short space, and can be utilized. The nature of the soil or surface of the country through which the river runs has an important effect in influencing the habit of the stream in this respect, and so determining its value as a producer of power. If it be composed of sand, clay, gravel or even the softer and more easily decomposed rocks, it will usually be found that the river has worn its bed to a fairly uniform slope throughout, in which case there will be few opportunities of developing power from its waters. Even if a slight drop should occur, a dam would probably be required in order to obtain any considerable head, and the erection of dams, while often necessary and advantageous, involves additional expense both in construction and maintenance. In a river whose bed is composed of hard rock, such as is usually comprised in the Laurentian and Huronian formations of northern and western Ontario, the eroding force of the water meets with much greater resistance, and its course is more likely to be marked by abrupt changes of level in rapids and falls, and indeed this is characteristic of many if not most of the rivers in those parts of the province. Another prominent feature of the topography of these districts is the very large number of lakes, varying in size from mere ponds to large and important sheets of water. These are either the sources of or tributary to the rivers, or expansions of them, and act as reservoirs or storage basins, tending to regulate the flow of the water and to render it constant and steady throughout the year.

The character of the country in northern and western Ontario is therefore such as to provide an almost illimitable amount of water power readily available. Taking into account the annual precipitation of moisture in the form of rain and snow, there is no reason to doubt that hundreds of thousands of horse power could be generated from the waters of streams flowing into the great lakes with a minimum of trouble and expense. A shorter watershed running from the main one southwesterly round the western end of lake Superior divides the streams falling into that lake from those which find their way into lake Winnipeg and so into Hudson Bay, and the waters running in both directions from this divide furnish many fine water privileges, similar in character and equally available; while tributary to the Ottawa river, and in that part of the province included within the boundaries of Algonquin National Park, as well as to the south and west, are numerous rivers of considerable fall and volume, from which a very large additional amount of power could with little difficulty be obtained. The streams flowing into Hudson Bay, such as the Albany, Kenogami, Missinaibi, Mattagami and Abitibi are of greater average length than those running into the great lakes, and as they descend to the level of the sea, say 600 feet below that of lakes Superior and Huron, many falls are to be found upon them, particularly in their upper reaches and in the neighborhood of the "long portages," where their waters are interrupted by the hard rocks of the old formations on their way to the more level Devonian plains bordering on James Bay. For the present, however, these rivers are too remote to be regarded as sources of available power, though the time may come when they will be called into requisition. But on the Seine, Atikokan, Wabigoon, Winnipeg and Rainy rivers, on the Mattawin, Kaministiquia, Nepigon, Steel, Pic, Magpie and Michipicoten, on the Mississaga, Thessalon, Spanish, Vermilion, Wahnapitae and Sturgeon, on the Montreal, Ottawa, Petawawa, Bonnechere and Madawaska, on the Muskoka, Maganetawan and Severn, and on many others there are numerous falls and rapids waiting to be utilized and capable of doing the work now being done by all the steam engines in Ontario a hundred or a thousand times over. This is leaving out of view the waterfalls already developed and in use in the older portions of the province, as well as the stupendous energies of the falls of the St. Mary and Niagara rivers, which are already, one on the Canadian and the other on the American side, to some extent made use of.

The rivers enumerated above are situated among the forests of pine and hardwood, which cover so considerable a portion of New Ontario, and in many cases they are contiguous to valuable deposits of ore or mineral. The raw material for many industries lies around them. The sawmill, planing mill, sash and door factory, pulp mill, match factory and many other woodworking industries might happily combine abundant raw material and cheap power on these streams, while stamp mills and other mining plants might be worked with profit and success. Other industries, such as woolen, cotton and flour mills and chemical manufactories might avail themselves of the cheap power without necessarily locating in the immediate neighborhood of the waterfall, by connecting themselves with it by means of the electric current, though for textile, paper and other industries whose processes necessitate the use of large quantities of clear water, a waterfall convenient to means of transportation forms an ideal site. Electrically driven railways seem likely to come into vogue in this and other parts of the world because of their low first cost and inexpensive maintenance, and it appears feasible to operate electric roads by currents generated by the waterfalls on the rivers in many parts of the districts referred to. Such railways might serve a very useful purpose in carrying lumber, ore, raw and finished material and supplies of all kinds in a country where perhaps the volume of traffic might not be sufficient to render an ordinary steam railway a profitable undertaking.

Water power, whether employed directly to operate machinery, or converted into electric energy for the same purpose, has many advantages over the steam engine. For the same quantity of power, its first cost is not usually much greater, and often not so great, and once installed it requires little or no attention. Its danger to life and property is less. It needs no fuel, a consideration specially important in Ontario, which has no coal beds, and where in time even the present abundant supplies of wood will be exhausted. Hitherto the chief disadvantage of water power has been its immobility. If a waterfall was not conveniently situated, it was of little or no use If it did not pay to place a manufactory alongside a waterfall, the fall could not be brought to the factory. Now this has to a large extent been changed and power can be delivered without serious waste many miles from where it is electrically produced. The change will be still more marked when the problem of transmitting electric energy through long distances has been thoroughly solved, and Nikola Tesla looks forward to a speedy solution.

The presence of so many available water powers in the Lake of the Woods, Seine River, Wahnapitae and other mining districts of Ontario is a fortunate circumstance, and cannot but have a very favorable effect upon their development. Cheap power means economy in working, and will permit of ore bodies being profitably utilized which would otherwise not pay for treatment. The immense deposits of low grade ore which are found north of lake Superior and on the Upper Seine are in many cases situated in proximity to waterfalls capable of yielding hundreds and thousands of horse power at comparatively little expense. The importance of preserving these water powers as far as possible for the general benefit and preventing

their being locked up in the hands of speculative individuals who would not use them themselves, but who would demand heavy toll for their use by others, has led to the adoption of new regulations under the Act respecting Water Powers, (61 Vict., chap. 8), passed at the last session of the Legislature. The principal features of these regulations are those which provide for the leasing of such powers by the Crown, instead of patenting them outright, and for the furnishing of surplus power by the lessee to others on terms to be fixed in case of disagreement by the Lieutenant-Governor in-Council.

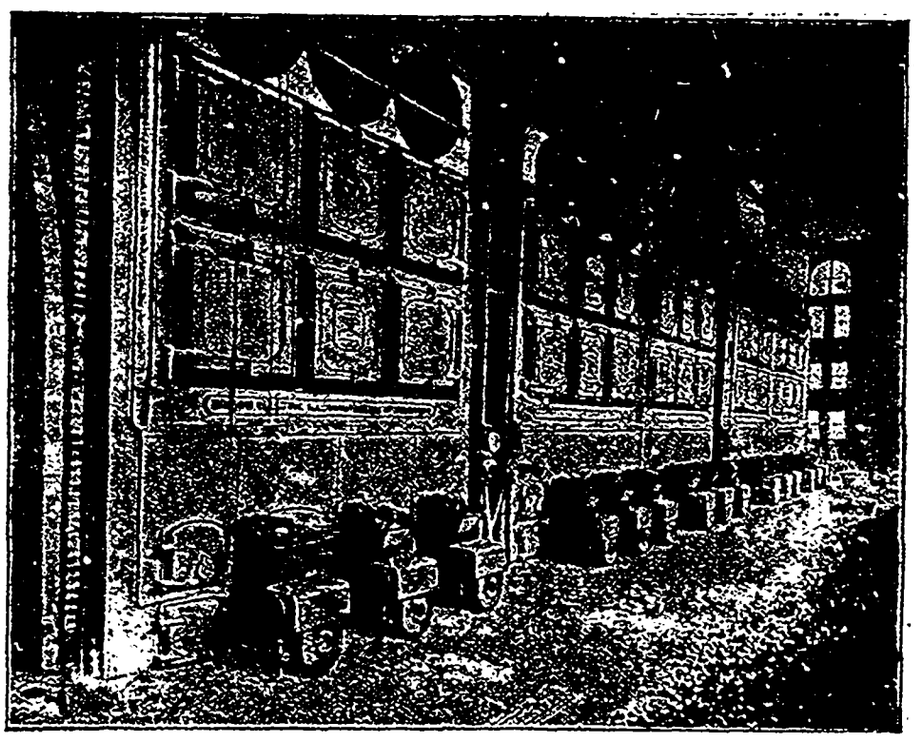
—The largest dynamo in the world is now being constructed by the Walker Co., of Cleveland, O., for the Boston Elevated Railway, Boston, Mass. This generator will have an output of 3,000 k.w. at 550 volts, or about 4,000 h.p. Its speed will be between 75 and 80 revolutions per minute, its total weight 250,000 lbs., and the diameter of the circular cast-steel field frame 21 feet, 7 inches. The weight of this ring without field magnets will be 25 tons. There will be 24 inwardly projecting laminated cores and pole having a combined weight of 15 tons. The armature hub is 13 feet in diameter and is in two parts, each of which weighs 10 tons. The shaft is 37 inches in diameter. The armature laminations add 15 tons, and the armature will have in all 594 slots. The commutator will be 105 inches in diameter, and will have 1,188 bars. To facilitate regulation and remove a portion of the strain from the shaft, the flywheel will be bolted directly to extensions on the armature hub. If this machine were to run at the speed of the Niagara generators, 300 revolutions per minute, it would have an output of 16,000 h.p.

ACETYLENE GAS LIGHTING FOR TRAINS.

In response to an enquiry as to the progress being made in car lighting by acetylene gas, A. Holland & Son, Ottawa, Ont., write that they are adopting a new system, because though the generators in use on the Pontiac & Pacific and Gatineau Valley railways give beautiful light it has been found they are troublesome to keep clean and charge, and the overflow of gas causes a bad smell in the car that is very offensive to some persons. Mr. Ressman, who is fully impressed with the future of acetylene as a car lighting gas, urged Mr. Holland to try and make a machine that would absolutely control the gas and do away with the principal difficulty—the odor from escaping gas. In view of the experience he had he discarded galvanized iron generators with rubber connections entirely, and a system that depended entirely on a water seal to retain the gas. "My new generator," writes Mr. Holland, "is made entirely of cast iron, with iron pipe connections and brass valves. It made its trial trip on Oct. 11th in a Gatineau Valley car. It proved to be a perfect success. The lights burned brilliantly throughout the trip, lasting 4½ hours. With six lights of 25 c.p. each the car was illuminated so well that I could read the evening papers with comfort from any seat in it. The vibration over the roughest part of the road had no effect on the lights, and better than all there was absolutely no overflow or leakage of gas. I am now at work on another apparatus designed specially for locomotive head lights. I expect to have it in operation shortly, and that it will be as complete a success as the car lighter."

THE AMERICAN STOKER COMPANY.

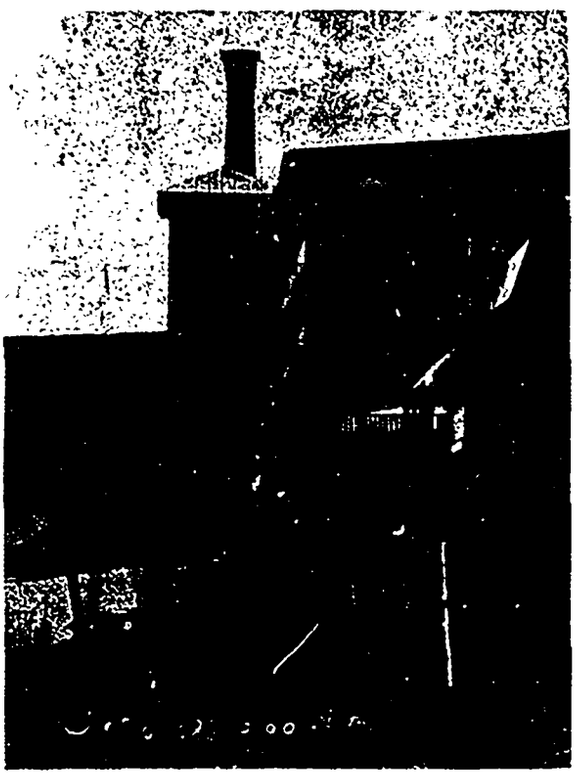
We publish herewith a series of engravings made from photographs representing the Dominion Cotton Company's Mill at Hochelaga, Que., prior to and after the installation of the American Stoker Company's apparatus in the boiler house. The second series of pictures almost give the impression that the mill is closed down, but on entering the mill, however, it is found that everything is in full swing, and on going into the boiler house at the time these photographs were taken, it was seen that the whole of the steam plant of about 700 h.p. was in operation, the boilers being fired by means of the American Stoker Co.'s apparatus with soft coal screenings. The photographs were taken at the request of the Dominion Cotton Co., by Mr. Dennison, photographer, St. Catherine street, Montreal, and Mr. Dennison went to the site and took these photographs without the knowledge of any one connected with the cotton mill. The series is taken at intervals of ten minutes to show that no special advantage was taken in selecting the moment of exposure.



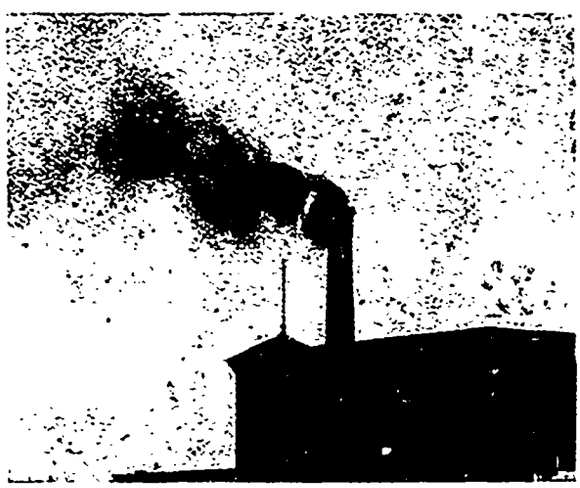
PLANT EQUIPPED BY THE AMERICAN STOKER CO., SHOWING THE AUTOMATIC STOKERS, AS IN USE AT UNION STATION, EDISON ELECTRIC ILLUMINATING CO., BROOKLYN, N.Y.

The stoker is thus described by its makers: "Immediately beneath the coal hopper, and communicating with it, is the conveyor pipe; this in turn communicating with the coal magazine. A screw conveyor or worm is located in the conveyor

JULY 22ND, 1898—10.00 A.M



SEPT. 9TH, 1898—10.00 A.M.



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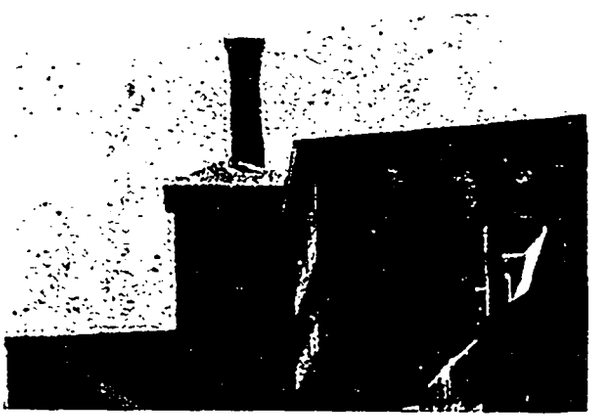

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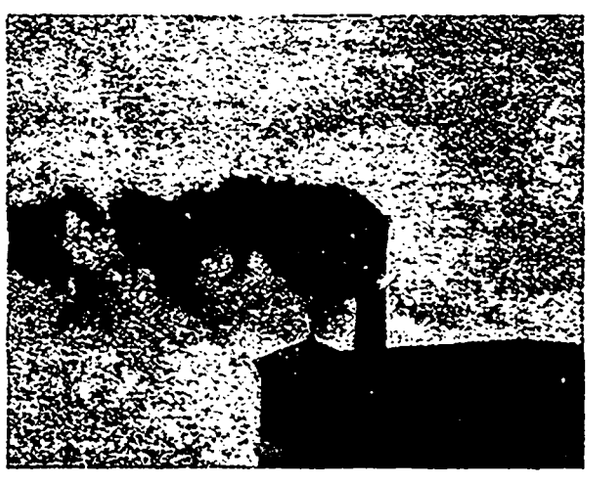

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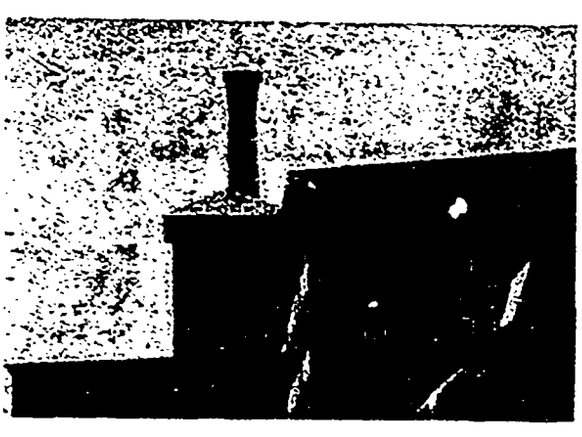

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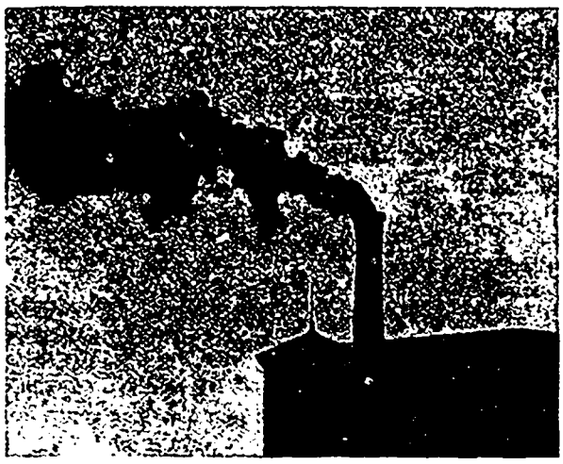

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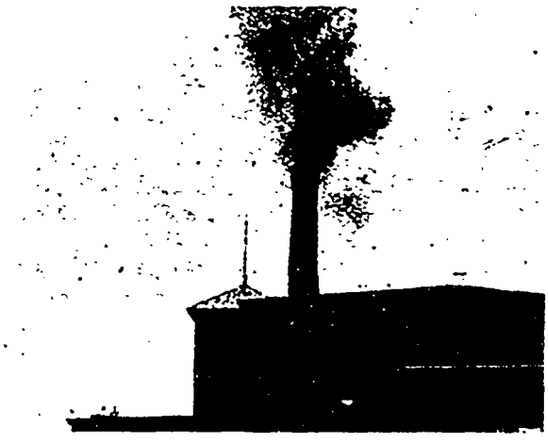

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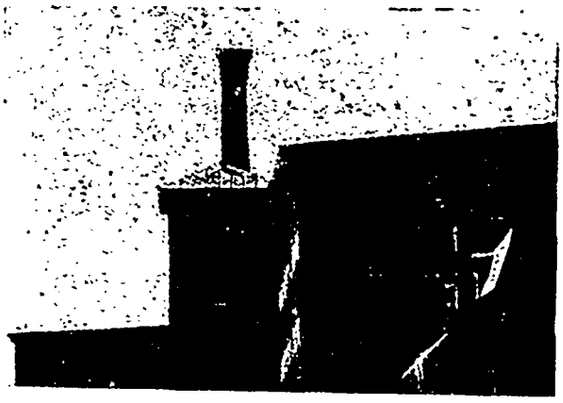

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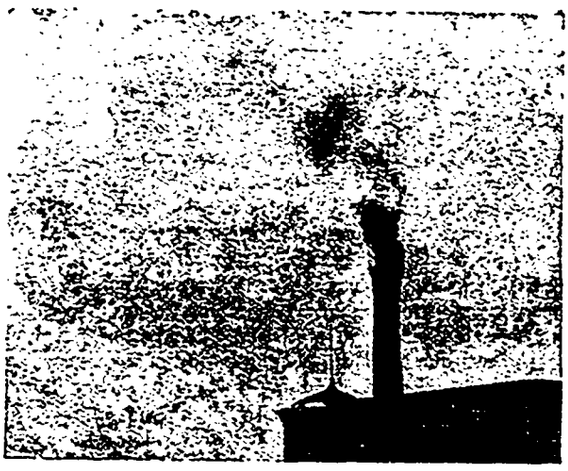

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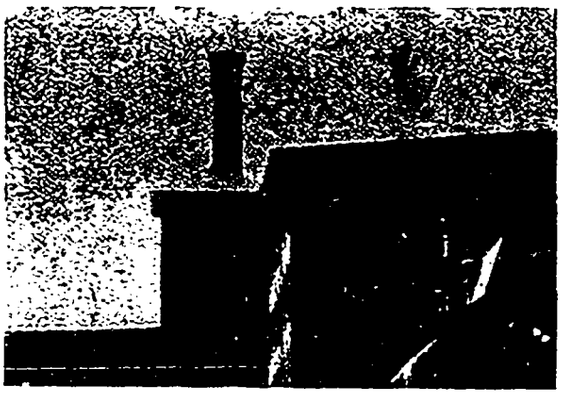


SEPT. 9TH, 1898—10.50 A.M.

pipe and extends the entire length of the magazine. Immediately beneath the conveyor pipe is located the wind box, having an opening beneath the hopper. At this point is connected the piping for the air supply, furnished at low pressure by a volume blower. The other end of the wind box opens into the air space between the magazine and outer casing. The upper edge of the magazine is surrounded by tuyeres, or air blocks, these being provided with openings for the discharge of air, inwardly and outwardly. Each stoker is driven independently by a small steam motor, located immediately in front and beneath the hopper. The motor has a simple reciprocating piston. Its piston rod carries a crosshead, which, by means of suitable connecting links, operates a rocker arm having a pawl mechanism, which in turn actuates the ratchet wheel attached to the conveyor shaft. The stoker is thus entirely self-contained and complete in itself, and consequently there is no danger of the driving and feeding mechanism (the only working parts) ever getting out of alignment. The rate of feeding coal is controlled by the speed of the motor, this being effected by the simple means of throttling the steam in the supply pipe to the motor. The shields covering the motor effectually protect the mechanism from dirt and dust. The coal is fed into the hopper, carried by the conveyor into the magazine, which it fills, "overflows" on both sides, and spreads upon the sides of the grates. The coal is fed slowly and continuously, and, approaching the fire in its upward course, it is slowly roasted and coked, and the gases released from it are taken up by the fresh air entering through the tuyeres, which explodes these gases and delivers the coal as coke on the grates above. The continuous feeding gives a breathing motion to this coke bed, thus keeping it open and free for the circulation of air. We call particular attention to the fact that every pound of coal fed into the hoppers passes

through this gas-making process, and there is no loss of coal through grates, by reason of the use of dead grates in the furnace, in place of open grate bars. The non-combustible is taken from the furnace in the shape of vitrified clinker. There is practically no soot, and with these results it is obvious that the combustion must be extraordinarily good.

"With our ability to feed the finest of slack coal we also handle lump coal, as any lump that can be fed into the hoppers will be crushed by the conveyor, there being provided a set of teeth, placed at the mouth of the conveyor, against which the coal is squeezed and broken." The American Stoker Company, whose Canadian office is at 54 Street Railway Chambers, Montreal, and is under the charge of W E Gower, is equipping quite a number of stokers in various parts of Canada and the United States.

ROPES AND ROPE DRIVING.*

BY L. H. KENYON, DUKINFIELD.

(Concluded from last issue).

Long Centres.—It is still a debatable question as to what distance unsupported ropes will convey power in a horizontal direction. Judging from the admirable manner in which ropes are working at 90 foot centres, the writer would have little hesitation in fixing them at a still greater distance. The main conditions are, well-sustained journals, plenty of room to permit the sag running clear of obstruction, and a liberal allowance for extra weight of rope—back driving, of course, always understood. The limit of endurance would be the same in any diameter of rope, as specific gravity and tensile strength are the same in proportion to the sectional area. For forward driving, much depends upon the diameter of the pulleys being sufficient to lift the outgoing from the incoming part of the rope.

Vertical Driving.—Pulleys fixed on the same vertical line may be successfully driven by putting on extra ropes, as the weight of the rope tends to fall out of the groove instead of into it. In this case, general efficiency depends greatly upon the elasticity of the rope.

Continuous Driving.—In America, Germany, and to a very slight extent in England, a system of rope driving known as the continuous rope, by which the power is transmitted through a single rope wound round the pulleys, is largely in use.

Cross Driving.—Up to this point, the question of rope driving has been treated as relating only to pulleys turning in the same direction. Ropes, however, may be as successfully applied to cross driving, with certain reservations, just as in the case of belts, gaining in frictional power, inasmuch as they cover more pulley surface, but at the expense of the ropes on account of continual contact in passing each other. To avoid the latter contingency as much as possible the pitch of the groove should be twice the usual distance, there being actually double the number of ropes at the crossing points. The ropes should also be crossed alternate ways in order that couplets may travel the same path in agreement and share alike the inevitable rubbing.

Rope and Spur Gearing Combined.—The difficulty of driving with ropes and spurs together, i. e., from one to the other either way, appears to be the result of back lashing, spurs being too rigid to yield to the more definite action of the ropes, which causes them to oscillate from side to side and often fly off the pulleys. It is a mistake to suppose that tightening will obviate these difficulties. This tends only to prevent reciprocal action, and we have known cases where teeth have been stripped as a result of tight ropes. Under such conditions, slack ropes are not only necessary but they should be fixed at different tensions in order to break the harmony without interfering with general efficiency. Each rope will then vibrate to a different rhythm, unless, which is not likely, the measure so arranges itself that unison of action is occasionally produced

Rope Speed and Power—Dismissing from our minds the vexed question of centrifugal force and the somewhat complex process of reasoning by which its effect upon high speed is supposed to be ascertained, it may be laid down as a safe rule to follow that a good cotton rope, 1¼-in diameter running at 1,000 feet per minute will comfortably transmit 10 h p, and that this power increases or diminishes in the same ratio as the speed. You may therefore expect this size of rope running at 7,000 feet per minute to transmit 70 h.p. Some of our ropes are, however, transmitting 93 h.p. each at a speed of 7,040 feet per minute, and on one occasion, owing to an accident to its fellow, double this power was for a time transmitted through a single 1¼-in. rope. We understand that an engine is now in process of construction which is designed for a rope speed of 8,000 feet per minute, or rather over 90 miles per hour, and is to transmit 80 h. p. per rope. Even this may ere long be exceeded. At any rate, it appears that the speed limit has not yet been reached. Taking the above relative size, speed, and power for granted, it now only remains to calculate the power of other sizes from the sectional area, which may always be regarded as that of a circle. A rope 1½-in. diameter will then transmit 7.34 h.p. and 1¼-in. diameter 5.1 h.p. per 1,000 feet of speed.

Thin v. Thick Ropes.—Referring to the much contested question of the relative efficiency of thin and thick ropes, actual practice contradicts the oft advanced theory that ropes, say from 1-in. to 1¼-in. diameter, may be run with greater advantage than the thicker sizes, allowing the same relative diameter of pulleys. In the matter of durability thick ropes certainly take the lead, and this may be accounted for by the fact that their wearing surface is greater in proportion to the sectional area: e.g., we will suppose that 2-in. dia. rope is worn ⅛ of an inch all round. This would bring down its actual strength to 1¾-in. diameter only, or as 64 is to 49. The same chafing on a 1-in. rope would reduce its strength to ¾-in. dia. rope, or as 64 is to 36. It may also be mentioned that this fraying is far more pronounced on small than large ropes. Two-inch ropes however, look rather clumsy, are not easily handled in splicing, and necessitate large pulleys. This may to some extent account for 1⅝-in. and 1¾-in. becoming favorite sizes.

Guide Pulleys.—There is scarcely an angle or position of shaft to shaft from which power may not be transmitted by means of ropes and guide pulleys. Take, for instance, the intricate arrangement for driving a spinning mule or traveling crane. It must, however, be noted that every additional pulley beyond the necessary driver and driven takes from the durability of the rope, not only on account of extra friction but from strain and contortion. In consequence of this, the average life of a crane rope is scarcely a tithe that of the ordinary driving rope.

*A paper read before the Manchester Association of Engineers.

CANADIAN ENGINEERS.

The following extracts are from an address by T. P. Trowern before the C.A.S.E. No. 2, Sept. 9th, 1898:

The term stationary engineer is not the best word in the English language to be applied to a certain class of men, any person would think, if we were not particular about the names we are known by we will not be very particular about our work. The word "stationary" in our dictionary means "fixed, not moving, not advancing, not improving." An engineer is a man who constructs and manages an engine for manufacturers and motive power of all sorts, including naval and military defence. There are mining, canal, lake, civil and sanitary engineers, in fact, all sorts of machinery to be kept in motion and repaired by them. Our medical and surgical men should be classed engineers because they keep the machinery of our bodies in motion. Within the last few years we have had brought to our notice electric, gas, magnetic, wind, railway and aerial engineers, and a number of others may spring up when we are taken away. An engineer is a man who is generally understood to be very active in attending to his engine and machinery, keeping it in good order and clean; do a few repairs himself; not a stationary man to look at some boy do the work. I would, therefore, propose that our society be called the "Canadian Engineers' Society," and open our doors to all engineers, and have among ourselves examining committees or boards for each branch of free lectures, with addresses and remarks which may be of much use and edification to us all. Union is strength, power and force. As all animal bodies are machines, men and women included, we should be all physical engineers of ourselves, and a benefit to our neighbors, we should study our own mechanism and see what can be done to prevent sickness, promote health and long life and a happy one; drop off all useless habits and

regulate our diet and rest as we do the steam to the cylinders and in the boiler, by a good safety valve.

When I look at the words "stationary engineers," for myself and position, I find that it does not well apply to me, as I have every day to overlook in the Toronto Asylum for the Insane, 50 closets, 25 bath-tubs, 30 wash basins, drains and ventilators, 6 water tanks (40,000 gallons), pipes and taps, about 300 working every day; 14 heating boilers—hot water system; 4 steam boilers, 2 for cooking, the baking of meat and everything by steam for 800 people in 14 kettles, and two others for laundry work (about 8,500 pieces are cleaned every week), with six washing machines, six mangles, and ironing machines, both steam and gas, 50 electric bells, 16 telephones, batteries, electric light and gas pipes, chandeliers, a blacksmith shop for doing all repairs about the house and farm, and burn 1,700 tons of coal per year. You cannot call me "stationary" when in addition to this I look after four hydraulic elevators and 2,240 feet of railroad with ten cars.

Mr. Trowern also read the following poem:

THE LITTLE CANADIAN ENGINEER'S BIRTHDAY.

He has given up his cradle and his little worsted ball;
He has hidden all his dolls behind the door;
He must now have a rocking horse, and a spinning top of course,
For he isn't mamma's baby
Any more.

He has now cut off all his curls, for they're only fit for girls,
And left them in a heap upon the floor;
For he's five years old to-day, and laughs to hear his parents say,
He'll not be mamma's baby
Any more.

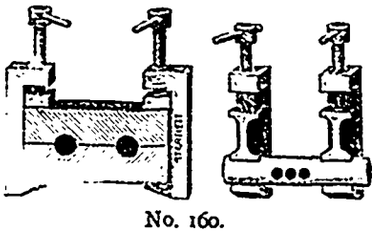
He has pockets in his pants like his older brother, Jack;
And he thinks he should have had them long before.
His boots are buttoned to the top; he jumps and will not stop.
Because he isn't mamma's baby
Any more.

He has heard his parents sigh, and has greatly wondered why,
They think he'll grow some day to be a man.
Now he's their darling little boy, then he'll be their pride and joy.
For he cannot be their baby
Any more.

When he's advanced in life and he thinks he'd love a wife,
His parents should direct him how to choose;
For he wants a happy home when his engine work is done;
And to be her darling boy
Ever more.

Yes, he'll find in her a mine, for she's worth her weight in gold.
She will save and make the best of everything.
She will read and play and sing, and he'll help the music ring;
He's her darling happy boy
Ever more.

TOOL MAKERS' STEEL CLAMPS.

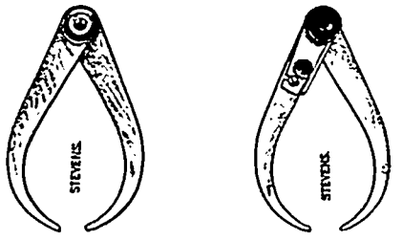


No. 160.

These clamps are made from drop forgings, nicely finished, case-hardened, and have take-up blocks to slip on and off end of screw, and are held to same in a novel manner. They will hold work square and parallel for laying out on surface plates, fitting or drilling, and the makers state that a round piece may be rigidly held in two of the clamps and drilled on an upright, central and parallel. They are put up and sold in pairs. With the small block in use, the capacity of the smaller clamp is a little over one inch, and that of the larger clamp two inches, and they are made only in two sizes, 1 inch and 2 inches, and a guarantee of their quality is the fact that they are made by the L. S. Starrett & Co., of Athol, Mass., and are put on the market by the Aikenhead Hardware Co., who report large sales and perfectly satisfied purchasers.

SHOP POINTERS.

In submitting "Shop Pointers and All-Steel Tools" to the mechanics of the country, the publishers, J. Stevens Arms & Tool Co., Chicopee Falls, Mass., fully realize the critical inspection to which it will be subjected. However, they invite inspection and criticism, for every tool they illustrated has the maker's approval and guarantee. They believe them to be mechanically perfect. The publishers solicit criticism and correspondence. If every mechanic into whose hands "Shop Pointers and All-Steel Tools" comes, will offer suggestions on tools, and give his ideas on using them, they will put this information into such form, they state, that they can give it to anyone who will write for it. A free interchange of ideas will help to make better mechanics; this means better wages. "All-Steel Tools," is our motto, to quote exactly. Whenever advisable, we harden our all-steel tools; in fact, no expense or care will be spared to keep our tools where they are now—at the front.



Man is fallible, and if through any oversight an imperfect tool should leave our factory, we will consider it a favor if the mechanic receiving it will return it to us, that we may make good the error. During the last year, where there has been chance for improvement, every tool and rifle manufactured by us has been remodeled; some have been discontinued. Everything now made by us is modern in every particular. We believe that our efforts in the course we are pursuing will be appreciated. We wish to work in closer sympathy with the mechanics, so they will feel there is one tool-making company that has their welfare in mind. This book is the only one from which tools should be ordered.

Chas. P. Fay, so well known as an inventor and designer of calipers, dividers and fine tools, has acquired the interest of his late father in the J. Stevens Arms & Tool Co., where he learned his trade and brought out his first calipers and dividers. The tool department is under his supervision. The Fay Ideal and Leader Calipers and Dividers are his latest patents in this line, while there are also ready, or in process of construction, several new tools which will fill long felt wants of mechanics. A few extracts from this little book, which will be sent free on receipt of a postcard to the publishers, are here given:

DEPRECIATION OF FIRST COST OF MACHINERY A YEAR.

	Depreciation.	Wear and Tear.	Total.
Engines	3 per cent.	3 per cent.	6 per cent.
Boilers	7 per cent.	3 per cent.	10 per cent.
Machines	5 per cent.	3 per cent.	8 per cent.
Gearing, etc....	3 per cent.	2½ per cent.	5½ per cent.
Bands & belts.		45 per cent.	45 per cent.

To Soften Cast Iron for Drilling.—Heat to a cherry-red, having it lie level in the fire. Then with tongs, put on a piece of brimstone, a little less in size than the hole is to be. This softens the iron entirely through. Let it lie in the fire until slightly cooled, when it is ready to drill.

To harden small tools or articles that are likely to warp in hardening, heat very carefully, and insert in a raw potato, then draw the temper as usual. A bar of hard soap is also good but will not make the tool as hard as the potato will. In laying out work on planed surfaces of steel or iron use blue vitriol and water on the surface. This will copper-over the surface nicely, so that all lines will show plainly. If on oily surfaces, add a little oil of vitriol; this will eat the oil off and leave a nicely coppered surface.

RULES FOR CALCULATING SPEED.

The diameter of driven given to find its number of revolutions.

Rule.—Multiply the diameter of the driver by its number of revolutions and divide the product by the diameter of the driven. The quotient will be the number of revolutions of the driven.

The diameter and revolutions of the driver being given to find the diameter of the driven that shall make any number of revolutions.

Rule.—Multiply the diameter of the driver by its number of revolutions and divide the product by the number of required revolutions of the driven. The quotient will be its diameter.

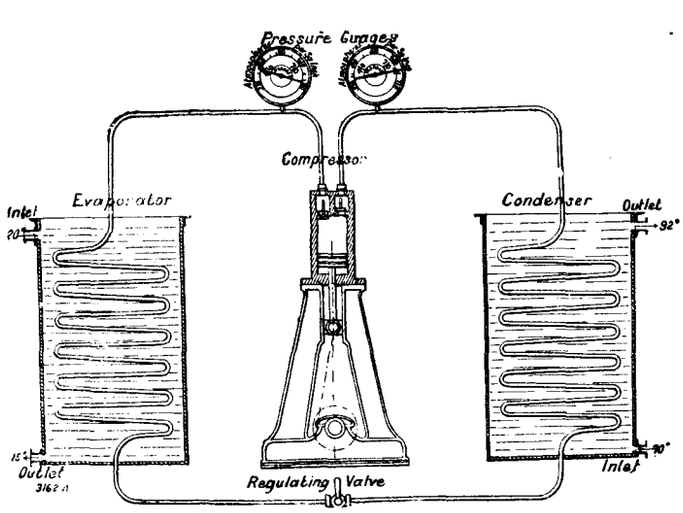
To ascertain the size of pulleys for given speeds.

Rule.—Multiply all the diameters of the drivers together and all the diameters of driven together; divide the drivers by the driven. Multiply the answer by the known revolutions of main shaft.

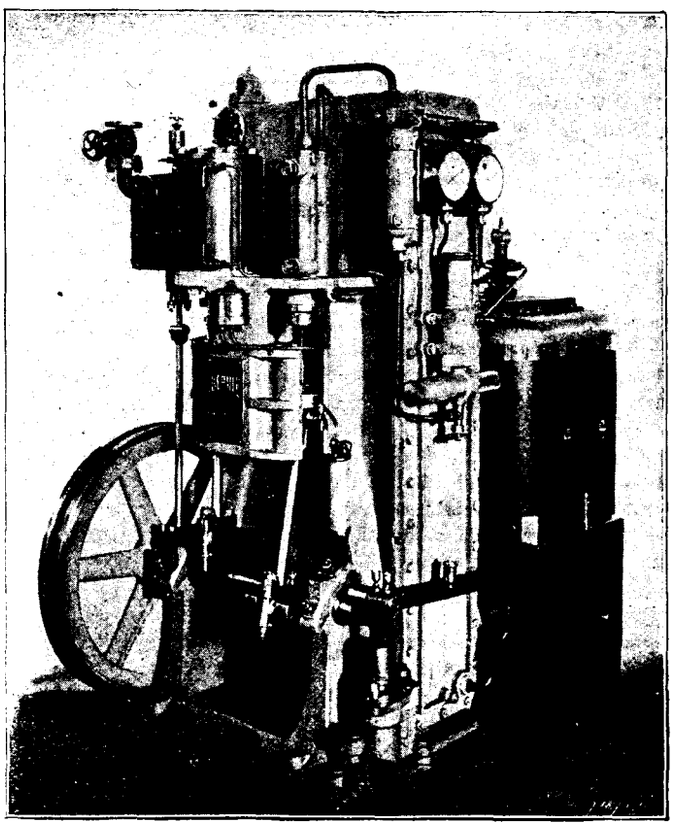
REFRIGERATION.

The Carbonic Anhydride Refrigerating machines, made by J. and E. Hall under their patents, consist of the following three parts: 1. The compressor (the only moving part), in which the gas drawn from the evaporator is compressed. 2. The condenser, consisting of coils, in which the compressed warm gas is cooled and liquefied by the action of cooling water. 3. The evaporator, consisting of coils, in which the liquid carbonic anhydride evaporates, producing any degree of temperature that may be required down to 80 degrees below freezing point. The charge of carbonic anhydride originally put into the machine is used over and over again, going progressively through the processes of compression, condensation, and evaporation. Thus a small quantity only is required to be added from time to time to replace any small losses, and for this purpose Carbonic Anhydride is sent in steel cylinders to any part of the world. The cost of the material is only a few pence per pound. The quantity required for a complete charge is very small, the cost of a charge for a 24-ton ice plant being only about $35. Carbonic Anhydride is stated by the manufacturers to be a non-poisonous gas.

The compressors for the large machines are bored out of solid steel forgings, to secure strength and soundness of the material, and to provide a perfect bore in which may work the



cup leathers with which the pistons are provided. Compressors of smaller machines are cast in a special bronze, which secures the two essentials of soundness and hardness. The gland is made gas-tight by means of two cupped leathers on the compressor-rod. Glycerine is forced into the space between these leathers at a pressure superior to the greatest pressure in the compressor, so that whatever leakage takes place at the gland is a leakage of glycerine either into the compressor or out into the atmosphere, and not a leakage of gas. What little leakage of glycerine takes place into the compressor is advantageous, inasmuch as it in the first place lubricates the compressor, and in the second place it fills up all clearances, thereby increasing the efficiency of the compressor. In order to replace the glycerine which leaks out of the glycerine lubricator, there is a small hand hydraulic pump, a few strokes of which are required to be made every four or five hours, as may be indicated by the position of the glycerine piston-rod.



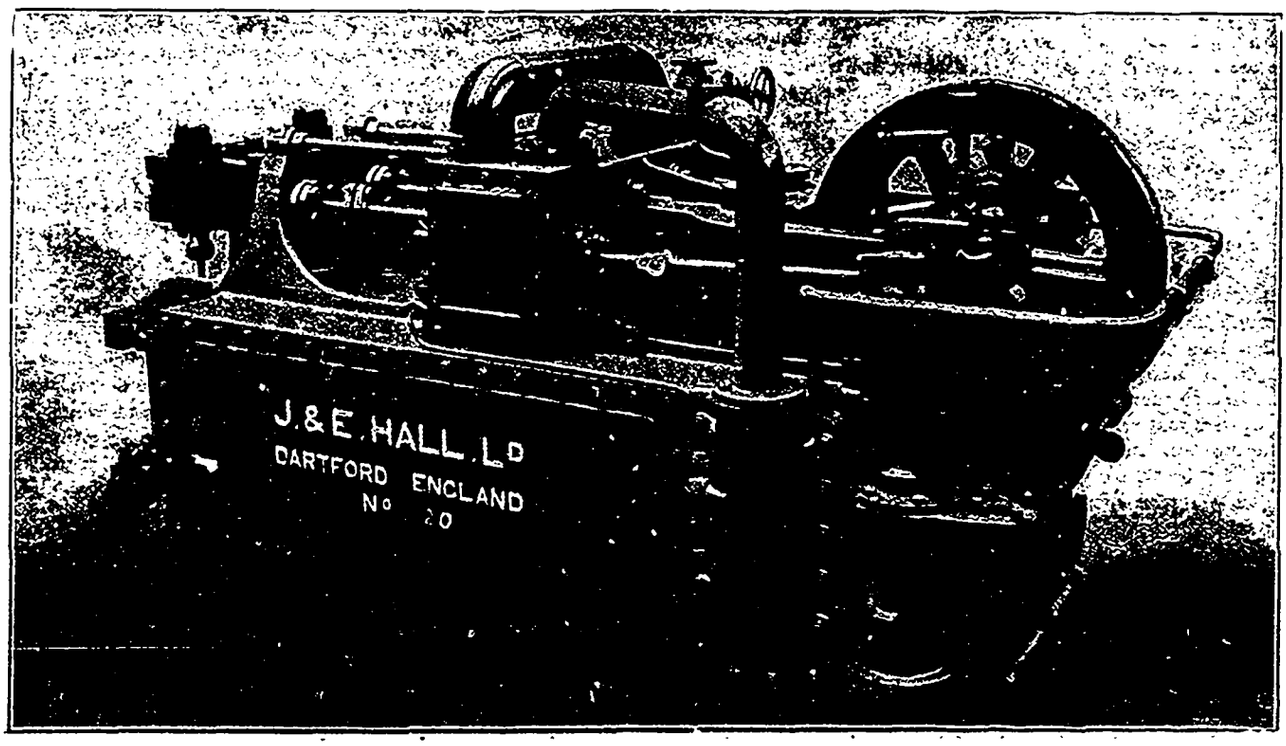
VERTICAL MARINE TYPE OF J. & E. HALL'S PATENT CARBONIC ANHYDRIDE REFRIGERATING MACHINES.

The condenser consists of coils of wrought-iron hydraulic pipe, usually of 13-16-in. bore, which are either placed in a tank and surrounded by water, or are arranged so that water trickles over them, forming the well-known atmospheric condenser. These coils are welded together into such length as to avoid altogether any joints inside the tank, where they would be inaccessible. The welding of these pipes is all done by the electrical method, which gives very reliable results. The condenser has, the makers state, one very important advantage of Carbonic Anhydride machines as is apparent, for as Carbonic Anhydride has no chemical action on copper, in the numerous cases where sea-water only is available for condensing purposes, that metal is used in the construction of the coils. The evaporator also consists of nests of wrought-iron hydraulic pipes welded up into long lengths, inside which the carbonic anhydride evaporates. The heat required for evaporation is usually obtained either from brine surrounding the pipes, as in cases where brine is used as the cooling medium, or else from air surrounding the pipes, as in cases where air is required to be cooled direct. Between the condenser and evaporator there is a regulating valve for adjusting the quantity of the liquid carbonic anhydride passing from the condenser.

As a refrigerating agent, liquefied carbonic acid is claimed to be second to none. Under atmospheric pressure it evaporates from the solid state at the particularly low temperature of 120 degs. F. below zero, or 152 degs. below the freezing point of water. In the refrigerating machine, however, it is caused to evaporate at only a few degrees below the temperature of the material which it is proposed to cool, the principle of the machine being exactly the same as that of machines using anhydrous ammonia on the compression system—viz., as water boils at 212 degs. F. under atmospheric pressure, and about 250 degs. F. at, say, 15 lbs. pressure, fire being usually the source of heat, so liquid carbonic acid boils at 30 degs. F.

at 35 atmospheres' pressure, and thus permits cold water to be the source from which the necessary heat to boil it is absorbed, exactly in the same manner as the heat of the fire is absorbed in boiling water. The compressor draws the gas from the evaporator and compresses it to the liquefying pressure, which is controlled within certain limits by the temperature of the cooling water. The heat due to compression is absorbed by the cooling water in the condenser, the gas circulating within the condenser coils and becoming liquefied by the time it reaches the lower extremity of these coils.

By regulating the pressure in the evaporator, the liquid is caused to boil throughout the coils of the evaporator, which act in the same manner as the heating surface in a steam boiler, and the temperature or boiling point of the liquid carbonic acid adjusts itself to that of the source of heat which is causing it to boil, whether it be water at 70 degs. to be reduced to 40 degs., or brine to be maintained at + 10 degs. F. or — 10 degs. F. The surfaces of the evaporator coils are so proportioned that all the liquid which enters at the lower end of the coil is evaporated by the time it reaches the top end, and thus the maximum efficiency is obtained. The compressor then draws in only gas, and compresses it up again to the pressure necessary to liquefy it, and delivers it warm to the condensing coils to continue the cycle of operation. These machines are extensively used on board ship, in cold storage warehouses, breweries, ice factories, etc., not only in Great Britain but throughout the British colonies and the world generally.



HORIZONTAL DUPLEX TYPE OF J. & E. HALL'S PATENT CARBONIC ANHYDRIDE REFRIGERATING MACHINES.

THE ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.

The eighth annual convention of the Association of Railway Superintendents of Bridges and Buildings was held at Richmond, Va., from October 18 to 20, 1898. The programme included many features of amusement and pleasure besides the reports of the various committees.

The committee on the subject, "Pile Rings and Method of Protecting Pile Heads in Driving," presented the following report: First. We find that the best way to protect the pile head is to use a 1x3-inch ring, made out of the best iron that can be obtained at the place where used. We recommend, where a railroad company have a steam hammer in its shops, that they make their pile rings out of hammered iron from old car axles. The cost of a 1x3—14-inch diameter ring is $1.75, while the same size ring made out of best bar iron costs $2. A pile ring made out of hammered iron will last to drive 75 oak piles and at least 300 cedar piles. The rings made out of best bar iron usually last to drive 50 oak piles and 200 cedar piles; in fact, one of your committee had 50 pile rings made out of old car axles four years ago, and since that time has driven 250 oak piles and 6,000 cedar piles without any renewal of pile rings. A pile driver should carry on the tool car 60 pile rings, 10 pile rings 15—30—14 inch., 10—13½ inch., and 10—13 inch. in diameter. The 14-inch diameter are the ones most used, 14-inch being the width of caps used by most roads. It is not necessary to have the pile head larger in diameter than the cap is wide.

Second. In fitting the pile ring, the pile should be neatly sawed off square, the pile should be neatly chamfered down at least 5 inches from the end, so the ring will just catch on and let the pile hammer do the rest. This is a little hard on rings, but in this way you are sure to get a good fit of the ring and the pile head is best protected.

The face of the pile hammer should be concaved to the depth of 1½ inches in the centre, and run out to nothing 2 inches from outside of the hammer; this will drive the fibre of the wood down slightly over the edge of the ring and make a neat fit of the hammer, and if the piles are kept exactly under the hammer, there is very little danger in fracturing the pile. The best weight of a pile hammer is 3,300 pounds. The height of the blow should not exceed 12 feet in driving cedar piles, or 20 feet in driving oak piles. It will be found that short, quick blows will drive the pile as quick as long blows, and are less liable to injure the pile. The pile should be neatly prepared before driving it; the knots should be neatly trimmed off, and the pile sharpened to a 4-inch square point for hard driving, the point to be made as near straight with the pile as possible. Piles should never be over-driven. When a pile does not go over 1 inch at a fall of 10 feet with a 3,300-pound hammer, the blow should be shortened to 6 feet, and the pile carefully driven until it stops going or does not go over ¼-inch at a blow. The driving of piles for railway traffic, and for all kinds of structures, requires a great amount of judgment to do good work.

The report of the Committee on the care of iron bridges after erection, including the best method of protecting them from salt water drippings from refrigerator cars, stated that the successful maintenance of a bridge will depend upon the character of the bridge to be maintained—a bridge which has been properly designed requiring less attention than one which has been bungled. By "less attention" it is not to be inferred that

neglect is meant. If the bridge was first class in the first place, and by "first-class" is meant one which has been designed by an engineer thoroughly familiar with this class of work, the material of which is of the best quality obtainable, and an assurance of that quality being evidenced by tests and inspection, the shop work on which has been done in a shop thoroughly equipped to do good work and a competent inspector being present to see that this work is done, and finally one that has been erected without abuse, and left in perfect condition, without a loose nut or rivet and which after having been thoroughly cleaned of all dirt and loose scale, has been painted with at least three coats of the best paint obtainable, then the proper care of this bridge means merely to keep it in as good condition as it was the day it was put up. This seems simple enough on its face, but unfortunately those who have charge of the maintenance of the bridge are so relieved after they get possession of a first-class structure, that they turn their attention mainly to other bridges and are inclined to allow the new one to take care of itself without any special attention for a number of years. Even the inspector whose duty it is to go from bridge to bridge regularly passes over this new structure with the thought, "it was just put up a short time ago and there can be nothing the matter with it;" in fact the new bridges are too often almost neglected on account of the attention which must be given to those which are bad. The care of new plate girder bridges of modern design involves less actual labor than any other class of bridge work, but there are many plate girders which are of defective construction carrying trains to-day. Their webs may be ¼-inch thick, rolled in short lengths and spliced together by an insufficient number of rivets and not sufficiently stiffened against buckling. Their flanges may be composed of light flange angles to which are riveted heavy cover plates, and the transferring of the strain of the flange angles through the webs is done by rivets made ⅝-inch in diameter and spaced at such a distance apart as to subject them to the danger of shearing off. The care of such a bridge is a serious question, as there is no good way to strengthen it. It should be trestled and renewed as soon as possible. In the above but little has been said concerning the painting of a bridge. The kind of paint to be used is a matter which many engineers are not fully agreed upon, and has been a subject of discussion at previous meetings of this society. The committee therefore consider that they are not called upon to enter into this question further than to say that no matter what kind of paint is used, no matter what is paid for this paint, and no matter how well the paint is applied to the surface, if that surface has not been thoroughly cleaned of all rust, scale, dirt, and grease before the paint is applied, it will not give satisfaction. The question of best method of protecting bridges from injury by salt water drippings is one upon which little can be said. That this dripping is very injurious to metal none will question except perhaps the owners of refrigerator cars. Some little interest is being taken in this subject by the officials in charge of track and bridges, but little or none by those in charge of the transportation departments, and while the remedy should be applied to the cars instead of the bridges, there will undoubtedly be opposition to this method by the car owners, who will probably be very slow to provide their cars with the necessary protection unless forced to do so by the railroad companies' united action. Voluminous reports accompanied by diagrams were also presented on the cost and manner of putting in pipe culverts, on round house smoke jacks and ventilation on heat floors for shops and round houses.

LITERARY NOTES.

Soft Coal Burning is a most interesting discussion of the subject of boiler setting and construction, and the benefits of careful firing. The author is C. M. Higginson, and it has already reached its fifth edition. There are twenty pages of closely printed matter, all of which is of value to the steam producer.

Mechanical Draft for Steam Boilers, by Walter B. Snow, being an abstract of a lecture before Sibley College, Cornell University, has been reprinted from The Sibley Journal of Engineering, and we have been favored by the author with a copy. We will return to the subject at a later date when we can devote more space to it.

We have received the Engineers' Year Book, published by the Society of Engineers of the University of Minnesota, which comprises about one hundred pages and contains a number of instructive articles, among which one of the most instructive is that of the Reclamation of Wet Land, by W. R. Hoag, C.E.

Printers' Ink, New York, has gotten out a 70 page pamphlet neatly bound in rough green paper, which sets forth the great merits of this famous advertising weekly. The outside cover bears in red letters the statement: "American advertising is the best in the whole world, and Printers' Ink made it what it is."

The Whiting Foundry Equipment Co., Hainey, Ill., U.S., has sent us a copy of the second edition of their general catalogue. The firm also issues special catalogues of cranes, cupolas, air hoists, Avery holding machines, etc.

We have on our table a copy of Shop Pointers and "All-Steel" Tools, which is a neat and comprehensive catalogue, published by the J. Stevens Arms & Tool Co., Chicopee Falls, Mass., U.S.

The Ores of Nova Scotia, by E. Gilpin, jr., is a description of the gold, lead and copper deposits of Nova Scotia; it has not been written from a technical or scientific point of view, but intended to convey in a practical manner a fair idea of their extent, value and adaptability for profitable mining. The lead and copper deposits of Nova Scotia are as yet undeveloped, although they are wide spread and promising. The gold deposits, alluring from their display of free gold, have received locally much attention. This attention, as may be gathered from his brief remarks, has not been for many years of an encouraging nature, as it was an affection of the hope of immediate returns, and not an endeavor to reduce gold mining to its true position, a commercial enterprise. Until a few years ago the local capitalist wanted something rich, a fortune without labor, extracted from a golden bunch of quartz or from the pocket of an innocent investor. Now, however, the fact is recognized that gold mining is a business, not necessarily a roseate speculation; and veins and deposits are being profitably worked, on business principles, which, a few years ago, would have been spurned. Since this principle has been accepted it is safe to say that the gold interests of the Province, Mr. Gilpin states, have an assured future.

A copy of the Entropy-Temperature Analysis of Steam Engine Efficiencies, with a blank diagram arranged for easy application to any concrete case, prepared by Sidney E. Reeve, M.E., adjunct professor of steam engineering at the Worcester Polytechnic Institute, has reached us. The original discoverer of the entropy method to steam engine analysis was Prof. Willard Gibbs, of Yale University. Since then many engineers of prominence have subscribed to and used the method. The immediate progenitor of this present form of diagram was a similar one projected by Professor Boulvin, of Ghent University, a description of which will be found in Engineering (London) for January 3, 1896. This diagram not appearing to the author to be either convenient or exact for general use, it was modified by him to the form herein offered to the profession for adoption or criticism. The nomenclature and notation is in accordance with Professor Ewing's "Steam Engine and Other Heat Engines."

The Practical Tool Maker and Designer is a treatise upon the designing of tools and fixtures for machine tools and metal working machinery. It comprises modern examples of machines with fundamental designs for tools for the actual production of the work; together with special reference to a set of tools for machining the various parts of a bicycle. The author is Herbert S. Wilson, M.E. There are 189 illustrations, and the publishers are Henry Carey Baird & Co., Philadelphia.

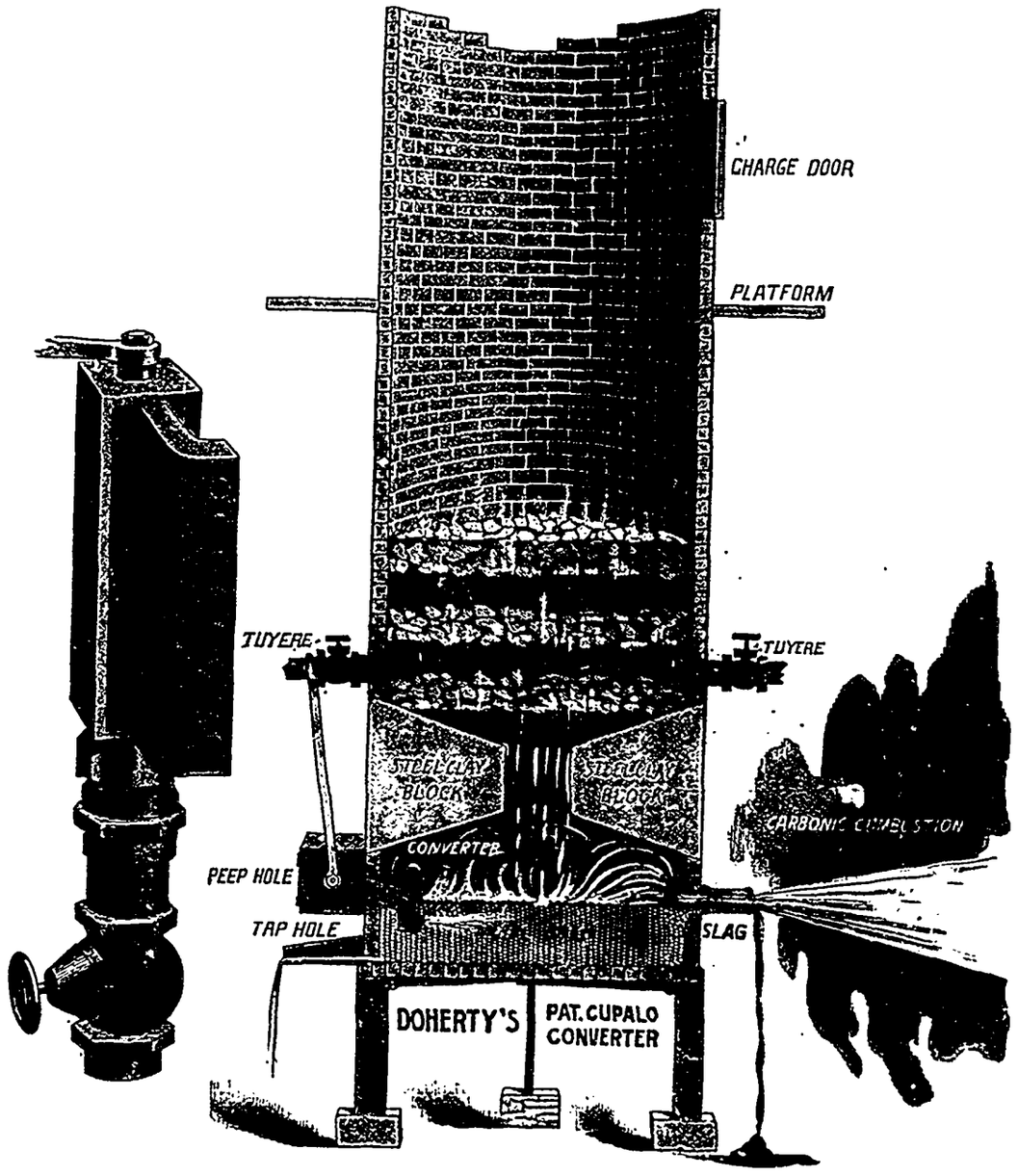
The Department of Colonization and Mines of the Province of Quebec has issued a special report by J. Obalski, mining engineer for the government, on the gold deposits of the province. It is entitled, "Or dans la Province de Quebec, Canada," and comprises some hundred pages of valuable statistics and general information.

W. A. Morehouse & Co., publishers of The Sherbrooke Examiner, deserve great credit for the artistic style in which they have produced "Sherbrooke Illustrated," a handsomely illustrated history and description of the enterprising capital of the Eastern Townships. The book contains over 100 pages,

and more than that number of half-tone engravings of the public buildings, colleges, schools, churches and other institutions of the city, with portraits of leading citizens and samples of the picturesque scenery of the Magog river, which gives to Sherbrooke so much of its beauty as well as its great commercial advantages in water power.

A DEPARTURE IN FOUNDRY PRACTICE.

This recent invention of Thos. Doherty, Sarnia, Ont., consists essentially of a cupola and pneumatic converter combined in one. An ordinary cupola is divided by refractory fire bricks so arranged as to form a double bottom or partition above where the pig and scrap iron is charged in the usual manner, as shown in cut. The metal, as it becomes melted, falls down through an opening into the converter chamber where it accumulates and forms what is known as a bath, upon which compressed air is applied, and it is claimed by the inventor, converts the molten metal into any quality of steel desired, by the operation of a valve in the blast pipe. The reaction produced is similar to that of all the other pneumatic processes and produces intense heat, burning out the silicon and carbon and carrying off the slag automatically through the opening at the side as shown. In other words the raw material is charged in above, melted, converted into steel and tapped out below by one operation. This process is more especially adapted to making steel machinery castings at a low price. The difficulty heretofore, in the general adoption of steel castings, has been the extra cost. The process is being generally patented on this continent and in Europe.



A Departure in Foundry Practice.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The first meeting of this society for the winter season was held at the society's rooms, Montreal, on Thursday evening, 13th October, P. W. St. George in the chair. There was a very large attendance, and the fortnightly meetings give promise of being very interesting.

After routine matters had been disposed of the secretary announced that a book had been opened in which to record the names of members seeking employment, it being the desire of members generally to assist those temporarily out of employment by giving them information of firms who might need their services. Several applications for membership in the society were recorded.

The following donations to the library were received: "Modern Methods of Sewage Disposal," from C. A. Biggar; "Surveying Instruments" and "Mathematical Drawing Instruments," from W. Ford Stanley; Report of the Hydraulic Engineer of Queensland on the Queensland Water Supply for 1897, from J. B. Henderson; "American Cements," from Uriah Cummings, of Akron, Ohio; "Centrifugal Pumps, Tur-

bines and Water Motors," from E. J. Boswell; photographs and pictures from J. W. Heckman, and a box containing about 100 volumes from John Kennedy.

The paper of the evening was by Prof. John T. Nicholson, of McGill University, on "Riveted Joints," which was not concluded, but is to be taken up again at the next meeting.

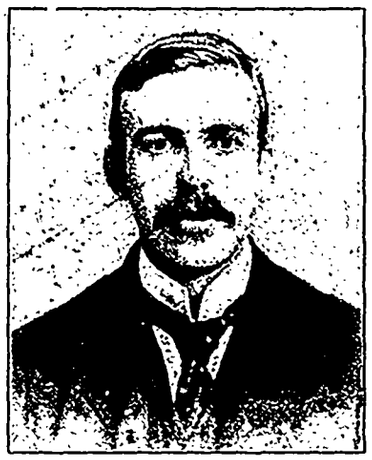
DR. JAMES WALLACE WALKER.

Dr. James Wallace Walker, M.A., Ph.D., the professor chosen for the new McDonald chair of organic chemistry in McGill University, Montreal, comes to McGill with a most brilliant record from the greatest teaching universities in England and on the continent of Europe. Prof. Walker is strongly recommended by Dr. Welhelm Ostwald, Ph. D., professor of Physical Chemistry in the University of Leipsic, one of the greatest of the world's great chemists. Dr. Walker was educated at the University of St. Andrews, Scotland, taking M.A. in 1889, as was stated in last issue of The Canadian Engineer, and after a short time spent in teaching mathematics at St. Andrews, he was appointed lecture assistant in chemistry at that university. In 1892 he entered the University of Leipsic and was shortly afterwards elected to one of the 1851 Exhibition Scholarships, holding it for three years, and received the degree of Ph. D. in 1896. In 1896 he was appointed lecturer in organic chemistry under Professor Ramsay, in University College, London, and was in 1897 also appointed examiner in chemistry for the Arts, Science and Medical degrees at the University of St. Andrews.

R. B. OWENS, E.E.

R. B. Owens, E. E., who has just been appointed to the W. C. McDonald professorship Electric Engineering at McGill University, is a native of Maryland, U. S., where his family has lived for generations, and where its members have held high positions of public trust. He was educated in Johns-Hopkins and Columbia Universities, obtaining the degree of E.E. at the latter. Prof. Owens resigned the charge of the Electrical and Steam Engineering Departments of Nebraska University to accept his present position at McGill. Among his most recent successes is the planning of the new engineering building for Nebraska University, which has been opened this month. At the Columbian Exhibition in Chicago Prof. Owens was a member of the jury in the department of electricity and chairman of the Electrical Committee, and as we stated in last issue of The Canadian Engineer was director of the Bureaus of Electricity and Machinery at the Trans-Mississippi Exposition at Omaha. He is a member of the Western Society of Engineers, the American Society of Mechanical Engineers, and the Council of the Society for the Promotion of Engineering Education, and vice-president of the American Institute of electrical engineers.

ERNEST RUTHERFORD, B.A., M.A., B.SC., OF TRINITY COLLEGE, CAMBRIDGE.



Ernest Rutherford, B.A., M.A., B. Sc., the professor of physics in McGill University, comes from Trinity College, Cambridge, and brings with him eulogistic testimonials from the faculty there, including a flattering recommendation from Dr. J. J. Thomson, M.A., Sc.D., F.R.S., professor of physics in Cambridge University. Prof. Rutherford, although already eminent in his profession, is a young man, having taken his first degree of Bachelor of Arts in the University of New Zealand in 1892, as we stated somewhat more fully in the October number of The Canadian Engineer, when we mentioned a few of the subjects in which Mr. Rutherford has made special research. He was made Master of Arts in the next year and Bachelor of Science in the year following at the same university. Coming to England he entered Trinity College, Cambridge, where he obtained the degree of Bachelor of Arts.

E. G. COKER, B Sc E.

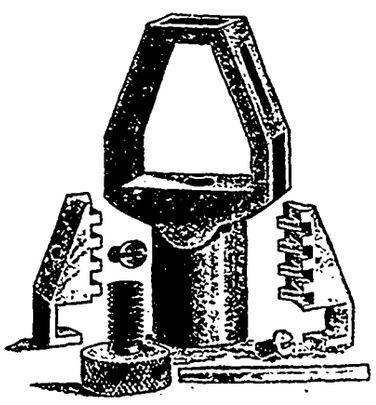
E. G. Coker was born in 1869, in Wolverton, and in 1883 entered the engineering shops of the London & Northwestern Ry., England, as a pupil, and served two years in the fitting, turning erecting and pattern makers' shops, and afterwards spent two years in the drawing office engaged in the design of railway plant and machinery. In 1887 he entered as a student of engi-

neering at the Royal College of Science, London, spending three years in the various laboratories of the college, passing out with a first-class associateship in mathematics and engineering. During period of training at Royal College of Science he gained the senior Whitworth exhibition for the year 1889, and in the next year the second Whitworth scholarship for proficiency in engineering science, these scholarships being open to all British subjects. After a short period in the works Mr. Coker entered the civil engineering course at Edinburgh University, being principally engaged in research work, passing out with the degree of Bachelor of Science in Engineering. After a year spent in engineering work he entered Peterhouse, Cambridge, and became a candidate for the Engineering Tripos, in both parts of which he was placed in first class, with special distinction being awarded in the subjects of "Theory of Structures and Strength of Materials" and "Heat Engines and Dynamics of Machines," being the only candidate who has up to now obtained these distinctions. During college vacations he spent the summer months in various works gaining experience in testing materials, constructive work and the like. Mr. Coker was elected (1895) a scholar of Peterhouse, and recently (1897) elected a member of the Institute of Mechanical Engineers. He has written papers on "The Tensional Strength of Solid and Hollow Shafting," and "On the Endurance of Steel Bars Subjected to Repetitions of Tensional Stress," published in the Proceedings of the Institute of Civil Engineers. He has devoted much attention to the design of instruments for measuring tensional strains, the results of which were embodied in a paper read before the Bristol meeting of the British Association in September last. Mr. Coker has just resigned the post of assistant examiner of patents in Her Majesty's patent office, London, to take up the duties of assistant professor of Civil Engineering at McGill.

FIRES OF THE MONTH.

Oct. 9th. Ott's tannery, Brantford, Ont.; loss on building, $2,000; contents, $1,000.——Oct. 13th. A small fire occurred in the Guelph, Ont., Linseed Oil Works.——Oct. 15th. Woodworking factory of Jos. Gosselin, Levis, Que.: loss about $25,000.——Oct. 17th. The Canada Eastern Railway Co.'s round house at Gibson, N. B.; six locomotives were destroyed. ——Oct. 19th. The Canadian Pacific Railway round house at Teeswater, Ont.; one locomotive was destroyed.——Oct. 26th. A. Thiboulot's carriage shop, Levis, Que.; loss about $15,000. ——Oct. 26th. W. H. Tighe's evaporator, Chatham, Ont.; remaining building destroyed; loss $1,000.——Oct. 26th. The Royal City Planing Mill Co.'s mill known as Hastings mill, Vancouver, B.C., burned, with damages $200.000, and $83.000 insurance.

THE NATIONAL DRILL CHUCK.



The following claims for the National Drill Chuck are made: 1. That the grip to hold a drill is unequaled by any chuck upon the market. 2. The construction is so simple that any person can put it together in one minute. 3. The simplicity of construction and arrangement of parts causes the least wear, making it the most durable. 4. It is the only chuck ever made that all parts are exposed to view, so that any irregularity can be seen at once. 5. It can be thoroughly cleaned in one-fourth the time of any other chuck. 6. All unnecessary material is removed, leaving the strength where required, and making it from one-third to one-half lighter than any other chuck made. 7. The only chuck that is easily cleaned, being so open that the dirt will not stay in, and can be blown or brushed out without removing the parts. 8. A chuck that is perfectly balanced and made in all sizes—large and small. 9. The only chuck that is strong and powerful, equally adapted for either light, swift or heavy work. 10. The only chuck made that is adapted for heavy work having tapering body, with jaws projecting, so when using small drills, it will not cast a shadow or interfere in seeing your work. 11. The only chuck made that by being perfectly balanced, and small at lower end, will do the work of two other chucks, thereby saving the expense of one. 12. The easiest chuck to repair, the least liable to get out of order, making it the cheapest to buy. 13. The only chuck made with an unfinished body for blacksmithing and carriage work, making it stronger, cheaper and equally effective for use. The National Drill Chuck is made with finished and unfinished bodies, the inside workings of both being the same. The body of the finished is polished, while that of the unfinished is left with a black, smooth surface as forged. It is made in seven sizes in capacities ranging from 0 to 2 inch. Further information can be obtained from Aikenhead Hardware Co., Toronto.

METAL IMPORTS FROM GREAT BRITAIN.

The following are the sterling values of the imports of interes to the metal trades from Great Britain during September and the nine months ending September, 1897, 1898 :—

	Month of September.		Nine months ending September.	
	1897.	1898.	1897.	1898.
Hardware	£7,041	£3,453	£50,672	£20,003
Cutlery	..	3,847	..	40,251
Pig iron	1,240	273	5,298	8,405
Bar, etc.	977	741	7,572	8,300
Railroad	171	2,147	38,893	25,154
Hoops, sheets, etc.	13,792	8,169	55,954	44,811
Galvanized sheets	7,346	4,445	35,547	44,252
Tin plates	30,073	5,667	132 840	104,039
Cast, wrought, etc., iron	3,887	4,041	25,957	24,457
Old (for re-manufacture)	1,937	..	5,191	3,754
Steel	6,258	4,282	41,061	39,734
Lead	5,170	4,339	19,062	24,665
Tin, unwrought	2,403	537	13,814	13,680
Alkali	5,808	4,210	26,082	32,035
Cement	3,757	2,934	15,611	17,927

WHO INTRODUCED THE EXPANSION CYLINDERS.

Editor CANADIAN ENGINEER.

Sir,—Touching the discussion that has been going on in The Scientific American and American Machinist as to who was the inventor of the second and third expansion cylinders in steam engines, Robt. W. Rule, Aylmer, Ont., adds a valuable statement. He says that in 1848 he was called out at St. John, N.B., to repair a boat called the "Reindeer," which ran between St. John and Fredericton. This steamer was fitted with a second expansion cylinder of the Wolff patent. Mr. Rule is a trustworthy machinist, and his statements could easily be verified at St. John. The old gentleman has many reminiscences of the famous Boulton & Watt "Soho" works near Birmingham, England, where he served his apprenticeship, 1840-6.

B.

CORRECTION.

In presenting in our last issue a synopsis of the paper "Remarks on the Systems of Refuse Disposal in Various European Cities," read by Thos. Macfarlane, chief analyst for the Dominion Government, before the American Public Health Association, a typographical error was made in describing the system in use in Bremen, Germany, which is that of using "Moss-Litter" as a deodorizer. This is also used in a hotel at Caledonia Springs, Ont., which Mr. Macfarlane mentions.

Industrial Notes.

J. H. Allan, Milton, Ont., is to establish a creamery in Carleton Place, Ont.

The St. Thomas, Ont., Brass Company has equipped a foundry at a cost of $10,000.

Lindsay, Ont., is lending $20,000 to Sylvester Bros., foundrymen, to extend their business.

Clark Bros., Toronto, have the contract for building the Normal School, London, Ont.

An iron bridge has been erected at Glendale, C. B., by R. Musgrave & Son, North Sydney.

The Geo. White & Sons Co., Ltd., London, Ont., is building a new boiler shop, 70x70 feet.

The Guelph Paving Co. will get a contract from Brockville, Ont., for about $60,000 of pavement.

The capital of the Page Wire Fence Co., of Ontario, Ltd., has been increased from $40,000 to $100,000.

Ker & Harcourt, spool and bobbin manufacturers, have removed their plant from Walkerton to Parry Sound, Ont.

Wm. Willoughby, brick and tile manufacturer, Carleton Place, Ont., is closing up business, and will dispose of his plant.

It is proposed to establish a match factory in Winnipeg, for which the city council is asked to give a bonus of $15,000.

Krug Bros. & Co., Chesley, Ont., have ordered an 80 h.p. boiler and engine from the Robb Engineering Co., Amherst, N.S.

Brantford, Ont., has granted the Chalcraft Screw Co. and the Nott Bicycle Company exemption from taxation for ten years.

Willis Chipman, C. E., has reported that necessary improvements to the Sherbrooke, Que, waterworks will cost about $62,000.

Arthur Hilyard and Jules Spiro, New York, are negotiating with people in St. John, N. B, for the erection of a pulp mill at Navy Island.

Waterloo, Ont., will submit a bylaw to be voted on Nov. 21st to raise $50,000 for the purchase of the waterworks and to complete the system.

Bannerman & Findlater, boiler makers, Ottawa, have just shipped two 80 h.p. boilers to the mills of McLaurin & McLaren at East Templeton, Que.

H. Sewrey, G. H. Sewrey and W. Johnson are building a foundry in Barrie, Ont. It will be a one-story frame building, 120 feet long and 36 feet wide.

Thurso, Que., has decided to have a waterworks system. The Stadacona Power Co., Montreal, has the contract for installing it. The price is $14,000.

The Guelph, Ont., Linseed Oil Co. is now in operation and is producing raw and boiled oil from Canadian flax seed. Fourteen men are employed at present.

The town of Dundas, Ont., is applying to the Legislature for power to grant to John Bertram & Sons, the famous machine tool builders, a bonus of $12,000.

Berlin, Ont., took possession of the waterworks on Oct. 8th, which have hitherto been operated by a company. The price paid by the town was $102,000.

E. G. Barrow, city engineer, Hamilton, Ont., proposes a new 30-inch main from the Beach pumping station to the city at a cost of between $161,152 and $181,815.

H. McLean, of Calgary, in company with Wanless & Carsons, has purchased the Calgary flouring mill, from the Manitoba Grain Co., and will refit it with new machinery.

The Granby, Que., Iron Works, owned by G. F. Payne, and comprising foundry, iron works and machine shops, have been disposed of to S. S. Dabble, Sandy Hill, N.Y.

The new drill-shed at Kingston, Ont., will be of stone, 230 by 115 feet, and will be erected in the old Artillery Park. Work will be begun on it at once. The cost will be $15,000.

W. G. Nott, J. T. Ham and J. H. Ham, M. A. Nott and C. W. Hoffmann, Brantford, Ont., have received an Ontario charter as The W. G. Nott Bicycle Company of Brantford, Ltd.

The statement of the affairs of the British Columbia Iron Works, Vancouver, B.C., published this month, shows losses of $126,000; the creditors have agreed to accept 50 cents on the dollar.

The Toronto Terra Cotta Co.'s works on the C.P.R., near Milton, Ont., which have been closed for some years, are being put into working order and will resume operations shortly on a large scale.

Tenders are called for a steel arch bridge at the Gorge, Victoria Arm, B.C., by the chief commissioner of lands and works, British Columbia, and will be received up to the 30th of this month.

The Paris Electro-Plating Co., Paris Station, Ont., has been compelled by growing business to build a moulding shop, 32x50 feet, and the company is now prepared to turn out fine gray iron castings.

The recent disastrous fires in Levis, Que., have opened the eyes of the town corporation to the necessity of a proper waterworks system, and at its last meeting it decided to construct one and have it in working order by Oct. 1, 1899.

City Engineer Barrow, of Hamilton, Ont., is collecting information as to the amount of garbage requiring destruction in the incinerator which the city health department is about to build by day labor.

W. H. Frost, proprietor of the Smith's Falls, Ont., Malleable Iron Works, is asking the town for a $10,000 bonus on condition of the works being so extended as to employ 50 more men. Freedom from taxation is also asked.

The ratepayers of Fort William, Ont., have been notified that the bylaw under which they proposed to borrow $35,000 for waterworks is of no effect, as more than a year has passed since the bylaw was carried. Another will be submitted.

R. A. Waite, architect, Buffalo, U.S., has been refused admission as a member by the Association of Architects of the Province of Quebec on the ground that the provisions of the constitution of the association did not permit of it.

The Truro, N. S., Headlight states that the Londonderry Iron Co. has sold the pipe plant and machine shop plant, at Acadia Mines, N. S., to the People's Heat and Light Co., of Halifax, and that it will be removed to that place this winter.

A large saw mill is being erected at Lake Temiscouta, Que., by James Miller, of St. John, and D. A. Huntley, of Parrsboro The mill, which is to begin operations next spring, will have a capacity of about 15,000,000 feet of lumber during the summer season.

R. Gray, J. S. Gray, M. Daniels, J. McEwen and M. Campbell, Chatham, Ont., are applying for incorporation as The Wm. Gray & Sons Company, Ltd., to manufacture all kinds of vehicles including bicycles. Chief place of business, Chatham, Ont.; capital, $150,000.

C. B. Frost, F. T. Frost, M.P., C. H. Frost, Maria E. Frost, and Caroline L. Frost, Smith Falls, have applied for incorporation as The Frost & Wood Co., Ltd., to carry on the machinery manufacturing business of Frost & Wood, Smith's Falls; capital, $800,000.

The Maritime Sulphite Fibre Company, Chatham, N. B., has ordered a 500 h.p. cross compound condensing engine from the Robb Engineering Company, Amherst, N. S., to replace their present 250 h.p. simple engine, and to provide for contemplated enlargements of their plant.

The cold storage building going up in London, Ont., at a cost of $40,000, is being built by Henry Lucas, Toronto, who has the contract for the brickwork and masonry. Hilliard & McKinley, London, will do the carpentering, and the iron work was awarded to the London Foundry Company.

Following is a copy of a letter sent from the Globe File Mnfg. Co., Port Hope, Ont., to the Dodge Mnfg. Co., Toronto, dated, Oct. 3rd, 1898: "We are reminded by your Mr. Hass that we have not told you how we like the last rope drive. We may say immense. We put it up as per your plans, started it to run and it went off so well we have only adjusted one pulley since. You may refer persons to us when talking rope drives. We would not return to gears again for four times what the four drives cost us. We feel you have used us well, we wish you made the ropes too, as we have faith in your ability."

The evidence in the arbitration for the ex-appropriation of the Campbelltown, N.B., waterworks is finished, and the Court adjourned until November 16th, when the argument will be heard. Willis Chipman, civil engineer for the town, values the plant at $51,000, and Jas. Laurin, civil engineer for the company, at $123,180.

The Model gas and gasolene engine which is being manufactured and placed on the market with great success by the Goldie, McCulloch Co., of Galt, Ont., is a very light, running, economical and useful engine, and is especially adapted for small installations.

Price Bros., Quebec, have bought ground at Batiscan, Que., for the erection of a saw mill, to which will be transferred their present business at St. Stanislas. The mill will be equipped with the latest modern improvements, lighted by electricity, and with a capacity of 200,000 logs per season.

The contract for laying a 10-inch main for the municipality of Verdun, Que., has been awarded to Matthew Dineen, contractor, Montreal. The Three Rivers Iron Works Co. is to supply the cast iron pipes and specials. Work was commenced on the 10th inst., under superintendence of McConnell & Marion, civil engineers, Montreal.

C. A. Birge, manager of the Canada Screw Company, Hamilton, Ont., states that he knows nothing concerning the probable sale of the works in this city, beyond the fact that the directors of the company have been empowered by the shareholders to make such disposition of the property as may be to the best interests of those concerned.

The Diamond Glass Company, Hamilton, Ont., which bought out the Toronto Glass Works about two years ago and transferred the blue-glass works from Hamilton, will remove also the flint-glass works, better known as the Burlington Glass Works, to Toronto, where exemption of taxation for its works has been secured for ten years from Jan. 1st next.

The Terra Nova Boiler and Engine Works, Ltd., St. John's, Nfld., has been formed, of which Hon. E. R. Bowring is president; Hon. A. W. Harvey, vice-president, and J. Anderson, secretary, with a board of directors consisting of Hon. J. Baird, J. Browning, W. B. Grieve, W. C. Job. The old business in Hoylestown has been taken over and will be greatly enlarged.

The St. John, N. B., Sun and other New Brunswick papers are discussing with a great deal of vigor the fact that various bridge contracts have been let without being advertised in the daily papers, and that changes have been made in the plans after the contracts were awarded, which materially cheapened the work. The Sun charges that in some cases those changes amounted to 50 per cent of the cost of the work.

The bylaw to make a loan of $30,000 to the Wm. Hamilton Mnfg. Co. has been carried by the ratepayers of Peterborough, Ont. The company will put up a new building 100 feet wide by 350 feet long, and 60 feet to the peak of the roof, paralleling the G. T. R track. A switch from the G. T. R. line would be laid through the building. The company is to pay 3½ per cent. for the loan, and to repay it, principal and interest, in 20 years.

The Lachine, Que., town council intends to take up the question of town drainage in a serious manner this coming winter. This question has been agitated for years, but in view of the large increase in population it presses for solution. The difficulty in the way seems to be a place or means of disposal, as it is impossible for Lachine to follow the filthy custom of the continent and pour its sewage into the river, to pollute the water supply of Montreal.

The E. B. Eddy Co., of Hull, have just installed what is probably the largest paper machine in Canada. The frame of the machine is 153 feet long, and it has thirty 120-inch driers. It is provided with ring oilers and the cylinders are cast hollow in one piece by a patent process. The bottom calendar roll weighs 1,585 lbs. The machine is driven by a 250 h.p. engine, and is capable of producing 20 tons per day of news, manilla or wrapping paper.

J. G. Pennycuick, F. W. Barrett, J. O. Buchanan, E. W. Cox and F. Wyld, Toronto, Ont., are being incorporated as The Pennycuick Glass and Light Corporation of Toronto, Ltd., to manufacture prisms, prismatic-glass, prismatic-globes, glass-conduits for electric wires, glass-tiles for wall decoration, and all products and articles relating to and necessary for the transmission and distribution of natural or artificial light; capital, $40,000; chief place of business, Toronto.

The electric motor carriages being built by the Canadian Motor Syndicate with the Still system of storage batteries are proving very successful. The carriages weigh, with batteries complete, only 750 lbs., and on a recent test the carriage ascended the steepest hills in Toronto, with the roads in a very unfavorable state, there being a great deal of mud. One of the leading business firms of Toronto has ordered a delivery van equipped with the Still batteries.

Since the advertisement was published calling tenders for the construction of the Quebec bridge, numerous applications have been received for information upon which to base tenders. Some of these come from England, France, Belgium, Canada and the United States. As it will cost contractors a large sum to make up a tender and the exhaustive plans that will require to accompany it, the number of actual tenderers is likely to fall very short of the number of those seeking present information.

The Syracuse Smelting Works, which recently opened a branch in Montreal for the manufacture of solder and babbit metals, have been so successful in extending their Canadian output, that it has been necessary to add another furnace to the works, making three now running. Business continues to be brisk and the company has just made a shipment of two cars of babbit metal and solder to Halifax, and two cars to St. John, N. B. They report their trade increasing all through Canada and prospects very bright.

Up to Sept. 1st last, the Detroit Lubricator Co., of Detroit, Mich., had manufactured and sold 400,000 Detroit Sight Feed Lubricators, and it is continuing at the rate of from 5,000 to 7,000 per month. Lubricator No. 400,000 went to South Africa, while lubricator No. 399,000, made about a week earlier, went to Java. Wherever there are steam engines, or any other kind of engines for that matter, the Detroit lubricators are in evidence, preventing friction, saving fuel, and making the lives of the engineers, as well as the machinery, run along more easily.

An important judgment was recently given by Judge Morgan, Toronto. Over a year ago the Canada Illuminating Company sold the Victor Light, which the Auer Light Co. claimed was an infringement on their patents. The Auer Light Co. started proceedings, and the judgment was given in a test case in favor of the Auer Light Co., holding that the Victor light was an infringement, and ordering damages at $2 per light. His Honor also ordered that the brasswork be delivered to the plaintiffs.

F. W. Eddy, West Newton, Mass., has bought land in Margaree Harbor, Cape Breton, where he will erect a large saw mill. The mill will have a 30 h.p. engine and boiler, rotary mill, shingle machine and a stave machine, consisting of a cylinder saw, heading rounder and stave joinder. The machinery, which is being supplied by the Robb Engineering Co., Amherst, N.S., will be on the ground and fitted up by the middle of November. This will be, it is said, the most completely equipped saw mill in Cape Breton.

The annual inspection trip of the directors of the Canada Iron Furnace Company, the Radnor Water Company and the Shawenegan Water & Power Company, was recently made the occasion of a pleasant excursion to what is rapidly becoming one of the industrial centres of Canada. Among the party were: Hon. Mr. Marchand, Premier of Quebec; P. H. Griffin, president of the Canada Iron Furnace Company; J. G. Smith, A. F. Gault, T. J. Drummond, W. J. White, E. L. Pease, Dr. W. H. Drummond, J. N. Greenshields, Alex. Pringle, Montreal, and Melville Aldred, S. Bagley, Capt. Piorkowski, of the German army, representative of the famous Krupp gun makers.

There was a large gathering of Ottawa Valley lumbermen recently at the W. C. Edwards' & Co., Ltd., mills, Ottawa, to see the test of the process for conversion of sawdust into commercial products. Prof. Ruttan, McGill University, Montreal, was also present. The visitors were shown through the building where the machinery is, and saw at one part wet sawdust being carried into the machine proper, coming out in tarry oils, pyroligneous acid, carbon and gas. The machine gets its fuel from the gas obtained from the sawdust. Another process for the treatment of sawdust, and the production of calcium carbide and the tarry oils, pyroligneous acid, etc., is being patented.

The Penberthy Injector Co., Detroit, has won its suit against the Lee-Penberthy Manufacturing Co., restraining the latter company from using the name Penberthy on its goods. Wm. Penberthy, whose patents were bought by the Penberthy Co., and improved by it, insisted upon his name appearing on the injectors. When he withdrew from the company and organized the Lee-Penberthy Co., he used his name on the injectors made by the new company. As the name had become well-known as describing the apparatus of the first company it was claimed as a trade mark of the first company and has so been allowed by the Court.

The Sarnia Salt Company, Ltd., of which Wm. Lord Moore, Chicago, is president, and W. J. Hume, Sarnia, secretary, has applied for permission to increase its capital stock from $20,000 to $100,000. The works of the company have been idle for some time, but it is intended to resume operations on a large scale. This development of the Canadian salt wells is not improbably connected with the prohibition of the export of Canadian logs to Michigan, says The Sarnia Despatch. The Michigan salt wells use the refuse from the lumber mills as fuel, and when that is cut off the cost of operating them will be greatly increased, thus affording a material advantage to the Canadian wells.

The Rossland Air Supply Co., Ltd., has been incorporated in British Columbia, with a capital stock of $200,000, and having for its subscribers C. K. Milbourne, Nelson, manager of the Dominion Mining, Development and Agency Company, and of the Cascade Water Power and Light Company; A. J. McMillan, Rossland; D. J. Fitzgerald, Trail; W. S. Norman, Rossland and Spokane, and F. Aug. Heinze, Butte, U.S. The company will develop water powers by the use of compressed air under what is known as the Taylor hydraulic air compression system, which has been fully described in former issues of The Canadian Engineer. The 14-inch air main from the place of development to Rossland will cost in the neighborhood of $130,000.

An important change has been made in the course of lectures on "Steam and the Steam Engine" at the Toronto Technical School. This consists of dividing the subject into two parts, so that as well as the lectures on "the theory of heat engines or thermodynamics" others will be given of a practical nature, dealing with "the indicator, valves and valve motions, efficiency of engines and boilers, gas engines," etc. Harris Elliott, B. A. Sc., who has charge of this course, has had considerable experience in the actual design and construction of engines, and it is hoped that in this way it can be made interesting to mechanics and others who are not qualified to take the theoretical work The practical lectures commenced Oct. 21st, at 8.30, with a discussion of "the indicator and how to use it."

The Ontario Government has concluded an agreement with an English syndicate by which E. A. Bremner, London, Eng., has secured from the Government the right to cut spruce timber on a reserve along the Sturgeon river.. The tract consists of 75 square miles of spruce lands. The company engages to spend a million dollars in buildings and plant, and will have an operating capital of two and a half millions. The pulp mill was formally opened at Sturgeon Falls, Oct. 1st, and the foundation of the first of six paper mills has been laid. The company undertakes to employ not less than 240 hands. The output will be 120 tons per day. The terms of the contract with the Government provide that all spruce cut must be manufactured in Ontario. Wm. G. Finlay, Lawrence, Mass., who has had eighteen years' experience, has been engaged as working manager.

Fetherstonhaugh & Co., patent solicitors, of Toronto and Montreal, furnish the following list of patents relating to machinery or engineering, granted to Canadians in the following countries. Any further information may be readily obtained from them direct: Canadian Patents.—Tanning machinery: J. H. Smith; automatic car-couplers, P. Hoff and E. Francis; belt shippers, C. Dawson; wire tightening device, O. Johnson; spring-cable, tension device, T. S. Witman; valves, F. Roy; frame saws, L. Long; hollow spring wire cable, J. Morlock; automatic switches, F. W. Ross; rock crusher and pulverizer, R. B. Seabrock; machine for weaving wire fence, J. Rocheleau; method of extracting precious metals from pulverized rock or sand, J. F. Latimer; machine for washing gold, E. L. Tetreau and W. M. Ogden; apparatus for separating ores, minerals, etc., W. T. Newman; trolley bases, H. G. Taylor. American Patents.—Apparatus for mining in frozen ground, S. H. and E. B. Haycock; chemical engine, T. Down; mechanism for imparting successive or alternating movements, E. Moore.

J. A. Simmons and the International Sanitary Gas Company, West Virginia, have begun suit in the United States Court against L. G. Harris, Toronto, to enforce a contract which they claim he refuses to carry out. Harris is the patentee of a method of making gas from garbage. It is alleged in the complaint that he agreed to sell to Simmons, or to a company which he was to form, all the patents he had obtained or might obtain, for the sum of $500,000. He was to receive $1,000 on the signing of the contract, and $5,000, $24,000, $25,000, $25,000 and $200,000 in one, two, four, five and six months from that date, the balance to be paid within a year. It was further agreed that when the company was formed all of the capital stock was to be turned over to Harris as security, and he was to deposit it with the Manhattan Trust Company. In case of default of the payments, Harris had the right to break the agreement. The company was formed and the agreement was signed on April 27, 1898, and since that time it is alleged that Harris has been paid $10,000. When a tender of the stock was made he refused to accept it, claiming that the contract was void. The claimants ask that the Court issue an order compelling him to carry out the terms of the contract and restraining him from disposing of the patents.

Electric Flashes.

Hull, Que., is having estimates prepared for a municipal lighting plant.

The Rogers Electric Co., London, Ont., is establishing a branch in Toronto.

Edward A. Evans succeeds F. H. Badger as manager of the Montmorency Electric Light and Power Co.

C. Snell and Tremaine have bought the electric lighting plant from the Exeter Electric Light Co.

The Cataract Power Co. began to supply power for incandescent lighting to Hamilton, Ont., Oct. 23rd.

The C.P.R., Montreal, has purchased a two-phase induction motor from the Canadian General Electric Company.

The Canadian General Electric Company has sold an electric plant to the Oxford Mnfg. Co., Oxford, N. S.

The Hamilton, Ont., Radial Electric Railway Co. will extend its line from Burlington, Ont., to Port Nelson.

Munderloh & Co., Montreal, have purchased a 200 light dynamo from the Canadian General Electric Company.

At a recent meeting of those chiefly interested in the Cornwall Street Railway several extensions and improvements were decided upon.

Jos. S. Craig has been appointed electrician to the Toronto Fire Department in place of Electrician Gibson, who has resigned from illness.

Glace Bay, Cape Breton, is to be lighted by electricity. Over 800 lights have been already subscribed for, and the plant will be installed this fall.

The Lachine Rapids Hydraulic Land and Power Co. has placed another order with the Canadian General Electric Co. for a three-phase induction motor.

Whitby, Ont., has sat in darkness recently, owing to a disagreement between the town council and the local lighting Company as to the renewal of a contract.

The British Columbia Sugar Refinery Co., Vancouver, B.C., has purchased from the Canadian General Electric Company one of its new type 25 k.w. multipolar generators.

W. C. McDonald, Montreal, whose generous gifts to McGill University have caused him to be held in honor all over the Dominion, has made an additional donation of $35,000, to be spent on the Department of Electricity in raising it to the same standard of completeness as the other departments.

James Donaldson, Bayfield, Ont., has disposed of his electric light plant and saw mill to N. M. Contine, St. Joseph, Ont.

Bradford, Ont., has accepted the tender of the Johnston Electric Co., Toronto, of $1,900, for installing and equipping an electric light plant.

The T. Eaton Co., Toronto, has ordered a 50 h.p. automatic engine for direct connection to dynamo, from the Robb Engineering Company.

Port Perry, Ont., council has granted Dr. Mallow the right of erecting telephone poles on certain streets so as to connect with Prince Albert, Ont.

J. Robinson & Co., Winnipeg, Man., have purchased a 10 h.p. slow speed 500 volt multipolar motor from the Canadian General Electric Company.

Jos. Graham, sawmill owner, Grand Valley, Ont., is burning his mill refuse to generate electricity to light the town of Arthur, Ont., ten miles away.

The Ottawa Street Railway Company will install a large storage battery plant to compensate for the fluctuation in power caused by anchor ice in winter.

W. B. Lanigan has retired from the Board of Directors of the Galt, Preston and Hespeler Street Railway. J. W. Leonard, superintendent of the C.P.R., succeeds him.

The London Electric Company has just placed an order with the Canadian General Electric Company for two standard No. 12 125 light multi-circuit Brush arc dynamos.

The Gulline Pneumatic Collar Co., Granby, Que., is putting in a large electro-plating apparatus, building an addition to the factory, and increasing the size of the steam plant.

W. Miller, Esq., Glen Miller, Ont., is installing a new electric plant for his paper mills, and has purchased a 150 light machine from the Canadian General Electric Company.

J. C. Wilson & Co., Lachute, Que., have purchased from the Canadian General Electric Company for the lighting of their premises, a standard 17½ k.w. multipolar generator.

The Petrolia Topic thinks that the proposed electric railway from Sarnia to Petrolia would be a big benefit to the tunnel town, but Petrolia would be deprived of considerable trade.

G. H. Harper, R. T. Wilson, J. J. Grafton, E. B. Harper and John Bertram, Dundas, Ont., have been incorporated as The Dundas Electric Company, Ltd., with a capital of $40,000.

G. T. Simpson, electrical manufacturer, Hamilton, Ont., was recently acquitted of a charge of unlawfully obtaining electrical energy from the Electrical Power and Manufacturing Co., Ltd., Hamilton.

James Barry of Niagara Falls, Ont., John Ross and John McRae have been given a contract for work amounting to $300,000 on the development of electrical power at Shawenegan Falls on the St. Maurice.

The C. O. Dell Electric Company, Annapolis, N. S., is doubling the capacity of its plant. E. Leonard & Sons have shipped them a large Leonard-Ball automatic engine, 120 h.p., from St. John, N. B.

Some of the influential citizens of Ste. Genevieve and Point Claire, Que., are considering the uniting of the two parishes by an electric road, having for its object enlarged facilities for communication with Montreal.

A movement is on foot in Ridgetown, Ont., to have an electric railway built between that town, Thamesville, Morpeth and Rondeau Park. Robt. Ferguson, M.P., and W. E. Gundy, are among those chiefly interested.

Prof. Rutherford, McGill University, delivered a most interesting lecture with a practical demonstration, on "The electrical transmission of messages without wires," before the Applied Science Society of McGill, recently.

J. A. Jamieson, superintendent C.P.R. elevators, St. John, N.B., has given an order to the Canadian General Electric Co. for a 30 k.w. generator, together with all the wiring material required to complete the installation.

R. McCallum, C.E., of the Public Works Department of Ontario, has inspected the power works of the Keewatin Power Co. for the Government. Alex. McQuarrie has been appointed manager of the works at Rat Portage, Ont.

Application for incorporation will be made to next session of the Ontario Legislature on behalf of the Toronto Elevated Railway Co., which wishes to build elevated and surface railways in Toronto and adjoining municipalities.

The town council of Port Arthur, Ont., has made an arrangement for an electrical and water supply from the Jenison power canal, at Kakabeka Falls, which was described briefly in our last issue. The contract has to be submitted to the electors.

The directors of the Victoria Industrial School, Mimico, Ont., have decided to install an electric plant for the lighting of the various buildings, and to carry out this work have purchased a 300 light plant from the Canadian General Electric Company.

L. Paquette, a workman employed at a building in the course of construction in Montreal, met his death a short time ago in a peculiar manner. He was working on a derrick, and the boom touching an electric wire formed a circuit through his body. Death was instantaneous.

The Canadian General Electric Company has just received an order from Wm. Cook, St. Catharines, for a standard 60 k.w. single-phase alternator. It is Mr. Cook's intention to undertake the furnishing of light to private consumers in connection with his present power plant.

The Hull Electric Company, Ottawa, is increasing its generating plant, and have purchased from the Canadian General Electric Co., a standard monocyclic generator, having a capacity of 150 k.w., with marble panel switchboard and instruments complete. This makes the third machine of this size type which this company has purchased.

The Department of Electrical Engineering, McGill University, Montreal, is adding to its electrical equipment a number of special generators, motors, transformers and testing instruments to be used in connection with the experimental work. An order has been placed for these requirements with the Canadian General Electric Company.

A Piers, superintendent of the C.P.R. Co.'s steamship lines, has placed an order with the Canadian General Electric Company for a direct driven unit to be installed on the steamer Alberta. This consists of a 25 k.w. generator, direct connected to a 9x10 "Ideal" engine. The order includes a marble panel with standard instruments and wiring.

H. Cargill & Son, Cargill, Ont., have decided to install an up-to-date electric plant for their requirements to furnish light and power to their residences, mills, barns and warehouses, and for this purpose have purchased a 500 light plant from the Canadian General Electric Company, together with several motors for operating machinery and elevators.

L. Becigneul et Cie, Lake Megantic, Que., are installing an incandescent electric system for the town, and for that purpose have purchased from the Canadian General Electric Company a standard 30 k.w. single-phase generator with marble panel switchboard complete. They have also placed an order with the same company for all transformers and wiring supplies required to carry out the work.

The corporation of Campbellford, Ont., has recently passed a bylaw for the purpose of remodeling and increasing its electric plant, and to carry out the work, has purchased from the Canadian General Electric Company a standard 120 k.w. single-phase alternator complete, together with all the transformers and wiring material required to carry out the work. It is expected that this will be one of the most modern plants in Canada when completed.

R. B. Owens, the new professor in charge of the electrical department of McGill University, is introducing a new feature which will be of great value not only to the students but will also confer great benefit upon the general public. This is the standardizing laboratory. There will be a room devoted to high potential machinery where a voltage of 200,000 will be obtainable. The old shafting in the electrical department is all being taken down and each machine will be driven by a separate motor. There will be machines of the various types—single-phase, two-phase, three-phase, and synchronous motors. New types of high tension transformers and alternating current machinery are being installed. Prof. Owens has been given practically a free hand in reconstructing the laboratories.

The Canadian General Electric Company has received an order from the T. Eaton Company, Toronto, for a 25 k.w. direct connected generator with marble switchboard. This makes the fifth unit which the T. Eaton Company has purchased from the Canadian General Electric Company, the entire establishment being lighted and operated from these installations.

Howes & Leighton, Harriston, Ont., has decided to comply with the request of the merchants of that place to provide incandescent lighting for commercial and residential purposes, as well as arc lighting, which they are now furnishing, and for this purpose have placed an order with the Canadian General Electric Company for one of its new type 30 k.w. single-phase alternators, with marble panel, instruments and all the transformers and wiring required for the installation.

The People's Telephone Company, of New York, was incorporated Oct. 12th with a capital stock of $5,000,000, to operate a telephone system in New York city and in other cities, towns and villages in New York and other States, and in the Dominion of Canada. The capital stock is divided into $2,000,000 preferred and $3,000,000 common stock. The directors are: S. B. Dutcher, J. E. Nichols, E. S. A. Deluna, Francis C. Travers, Frank Brainard, J. Fred Ackerman and Darwin R. James, New York.

The Metropolitan Electric Company, Ottawa, which was given a charter by the city council, recently, is applying for a charter of incorporation, with a capital of $500,000. James Robinson, F. Cains, Montreal; A. Broderick, T. Lindsay and W. Arnold, Ottawa, are the directors. It is stated that the company has bought the immense water power on the Ottawa river at Britannia, just above the city of Ottawa, from J. R. Booth for $20,000.

At the annual meeting of the Standard Light & Power Co., Montreal, the following directors were elected: W. McLea Walbank, president; J. H. Burland, vice-president; Peter Lyall, W. S. Evans, F. Dagenais, M. P. Davis. The company is now installing two large motors recently bought from a firm in Cleveland, Ohio. These will be operated from the Lachine rapids, holding the steam plant in reserve. It was decided to ask for tenders for rotary converters and fire-proof the Chenierville street power station.

Within another year Quebec, it is said, will be one of the best lighted cities in the world. It will have no less than three companies converting water powers in its vicinity into electricity. They will be the present Montmorency Falls Company, the Chaudiere Company, now in course of formation, and the Jacques Cartier Water Power Company, which has already commenced to build at the falls of the Jacques Cartier river in Valcartier, some 18 miles from the city of Quebec. This company will, it is said, build large pulp and paper mills at the falls.

Barrie, Ont., is determined to have cheap electric light, and will establish a plant of its own, unless the existing company sells out to the town at the town's valuation. Now the council cannot raise money for the new plant without issuing bonds. To issue bonds requires the consent of the county council. The county council holds $10,000 stock in the light company as security for the deficit of an absent county treasurer, and naturally does not see the reasonableness of aiding a competitor starting in business.

H. D. Symmes, St. Catharines, Ont., has secured the contract from the corporation of Merritton for street lighting with 20 arc lamps. Mr. Symmes has also decided to undertake the operation of a commercial lighting plant, and for his requirements for this purpose has purchased from the Canadian General Electric Company one of their 1,000 light, standard, single-phase alternators. He proposes operating a street lighting service from the alternating system, using 2,000 c.p. enclosed alternating arc lamps. These lamps he has also purchased from the Canadian General Electric Company.

Mining Matters.

Gold mining is being undertaken in Pontiac county, Que.

It is proposed to put in a smelter at the copper mine at Lower Wentworth, N. S.

Deseronto, Ont., is importing iron ore from Marquette, Mich.

W. Ogilvie, the new administrator of the Yukon, arrived safely at Dawson City, Oct. 5th.

There seems to be quite a revival of gold mining on a profitable scale in the Chaudiere Valley, Quebec.

A twelve-drill electric compressor for the Iron Mask has been ordered and is expected to be in operation in the course of a few weeks.

Gold and silver bearing quartz are reported from Chipewyan as being found on many of the islands in Great Slave lake.

The new machine plant in the Deer Park mine, Rossland, B.C., is working admirably, and Superintendent Mulholland is much pleased with it. The shaft is now down about 280 feet.

A report from Asbestos, Que., states that the asbestos company there is turning out several tons of asbestos per day. A new vein has been discovered, and is pronounced the richest yet.

Mica of a quality that has not been equalled so far, is reported from a point 200 miles north of Kamloops, B.C. The deposits are said to be 40 to 80 feet in thickness and great extent.

Reports from Cape Breton state that an immense deposit of magnetic iron was lately discovered there, running in width to 1,000 feet, and two miles long. Several shafts are now sunk across the lead 200 feet apart.

The first motors to be installed in British Columbia for the purpose were started up by the West Kootenay Power and Light Co., Ltd., at the works of the B.C. Bullion Co., Silica, about three miles from Rossland, B.C., Oct. 16th.

It is said that before summer comes again, the weekly ore shipments of Rossland, B.C., will reach the 10,000 ton mark. This result can easily be attained by shipping ore that is already in sight on the Centre Star, Columbia-Kootenay, No. 1, Monte Cristo, Deer Park, Virginia, and the Velvet.

Charles W. Willimott, of the Geological Survey of Canada, has recently been exploring for molybdenite. He found large deposits near Desert, in Ottawa county, and in Pontiac and Ross. He advises Canadian owners to retain what molybdenite bearing lands they may have.

It is reported from St. John's, Nfld., that the Montreal syndicate that have been boring on the west coast have found oil in the three wells which have been sunk, and the quality is said to be first-class. The Newfoundland iron mines have sold this year 86,000 tons of ore to Germany, while the coming year Germany will, it is said, take 160,000 tons.

J. Harvey is now operating in Manitoulin Island, with one of Fraser & Harvey's rigs and a crew of men, drilling for a firm of American prospectors. Their contract calls for ten wells, to be sunk from 500 to 800 feet each, according to the "show" they get. Oil and gas in small quantities have been stated to exist for some time, and an effort will be made to develop them on a commercial basis.

The double compartment shaft on the Iron Horse mine, Rossland, B.C., has now reached a depth of 34 feet, and two sets of timbers have been installed. The ground for the seven drill compressor has been selected. The intention is to use coal for fuel, and in order to save the haulage the plant is located alongside the railway track, so that the coal can be delivered direct to the furnace from the cars.

A gentleman representing a large English smelting firm has been in Canada for some time lately endeavoring to secure a shipment of iron ore from a Canadian mine in order to test the properties of the Canadian article. He made a proposition to several owners that they should let him have 500 tons at a certain figure, on the condition that if the ore turned out to be satisfactory, his firm would purchase anywhere from 100,000 to 200,000 tons per annum. He expected the owners of undeveloped iron properties in Canada would be only too glad to have their ores tested in this way. He found, however, that none of them were willing to let him have the 500 tons without receiving a cash payment of more than the ore was worth and a great deal more than it could be obtained for in the United States, where he finally went for his ore samples.

H. W. Treat, New York, secretary of the Van Anda Mining Company, stated a short time ago that their properties on Texada island were improving daily in development. They have reached 200-foot level by a double compartment shaft, and at 180 feet the ore body has widened out to 20 feet; seven feet of this went $50 to the ton, and the other 13 feet $12 per ton, and is splendid concentrating ore. At the 200-foot level it opens up a magnificent body of copper glance, four feet of which is 25 per cent. copper He states that a complete smelting plant is there ready for erection with the exception of the boilers.

W. A. Parks, lecturer in Toronto University, the geologist who accompanied the Niven survey party into Northern Ontario this last summer to extend the boundary line between Nipissing and Algoma, has returned in advance of the surveyors, to his duties in the university. Two years ago the Niven boundary line was run for a distance of 120 miles, terminating just north of Night Hawk lake. This season the work was resumed at the latter point, with the expectation of extending the survey to the Moose river, and thence connecting with Moose river. When Mr. Parks left the party the line had been extended for about 120 miles from Night Hawk lake to a point 16 miles east of the Abittibi river.

Rich gold fields have been discovered at Lake Atlin, in British Columbia, and the district is east of the summit of the Coast Range. Promising placers and good quartz have been found in the neighborhood of Lorne Creek and in the Skeena Valley, also east of the summit of the Coast Range. A gentleman, who spent the summer on the upper waters of the Lillooet, says, in The Victoria Colonist, that gold is distributed everywhere. He does not claim to have made any great discovery, but says that quartz veins are many and all of them carry gold. What there is in them can only be determined by development work. Such work as is in progress is full of encouragement. The existence of gold bearing country at these points along the eastern slope of the Coast Range suggests that what may be called a secondary gold belt extends along this whole region, which is about 800 miles in length.

Railway Matters.

The Canadian Pacific Railway Company is improving its elevator facilities at Port Arthur, Ont., by adding an extensive drying plant.

C. M. Hays, general manager of the Grand Trunk Railway, has ordered the construction of 200 additional flat cars for the system from Portland to Chicago.

The Collins' Bay Towing and Rafting Co., Kingston, Ont., have taken the contract to remove the wreck from the scene of the late Cornwall railway bridge disaster.

Mrs. F. Walker, Brooklin, has begun an action against the Ottawa, Arnprior and Parry Sound Railway for $10,000 damages for the loss of her late husband in a collision in May last.

The pople of Amherst, N.S., are promoting a railway from that town to North Port on the Northumberland Straits, about twenty miles, affording an outlet to an extensive coal and lumber country.

The lake steamer Empress of India was put into the dry dock at Picton and cut up into three. Her length will be increased by 45 feet, which will make her 227 feet long, and other improvements made.

The Lake Erie & Detroit River Railway will make another application to the towns and villages along the route for bonuses to aid in the extension of the line from Ridgetown to St. Thomas, Ont.

The contract for the construction of about thirty-five bridges between Montreal and Vaudreuil on the Montreal & Ottawa Short Line, which the C.P.R. Co. intend double tracking, has been secured by J. W. Munro, of Pembroke.

The Canadian Pacific has issued a circular, giving the hauling power of every locomotive on the line, and also what each one will carry, on every point in the division. By this new scheme, a trainmaster can see at a glance how many tons to put behind an engine.

Thos Power, contractor, has just finished the work on three bridges on the Drummond County Railway. The first in two spans over the St. Francis, 400 feet long and 36 feet high; the second over the west branch of the Nicolet, 140 feet long and 42 feet high, and the third at Petit Dechene, Moose Park, 100 feet long, and 32 feet high.

The Dominion Government railways system has awarded contracts for the construction of 300 box cars and 100 flat cars for use on the Intercolonial Railway. The Crossen Car Manufacturing Company, Cobourg, Ont., will furnish 100 box cars; the Rathbun Company of Deseronto, 50 box cars, and a Nova Scotia company the remainder.

The United States Supreme Court has decided that the Joint Traffic Railway Association is an illegal body. This judgment will have far-reaching effects. The association, of which the Grand Trunk and C.P.R. were members, was formed in 1895, its object being to establish and maintain reasonable and just rates, fares, rules and regulations on state and interstate traffic.

Hugh D. Lumsden, C.E., who has been in charge of the survey which the Canadian Pacific have been making from near Toronto to a few miles east of Sudbury, has returned. Mr. Lumsden reports that the survey is about complete and that a good line has been secured, starting from Clineberg, on the old Toronto Grey & Bruce, to a point four miles east of Sudbury, a total distance of 247 miles.

The Restigouche & Western Railway is making good progress under Engineer C. L. B. Miles. The first sod was turned Aug. 12 and ten miles of road were completed by Nov. 1.

The new shops of the Quebec Central Railway to be erected at Newington, Que., are to be operated by electric motors, the current being supplied by the Gas & Water Co., Sherbrooke, Que.

Application will be made to the Ontario Legislature for an Act to incorporate the Haliburton, Whitney & Mattawa Railway, to construct a railway from a point at or near the present terminus of the Grand Trunk Railway at Haliburton, to a point on the Ottawa, Arnprior & Parry Sound Railway, at Whitney, Ont., and in a northerly direction to Mattawa on the Ottawa river.

Important changes have taken place recently in the Intercolonial Railway. The position of general superintendent has been created and the office will be filled by Jas. E. Price, with headquarters at Moncton, N.B. The position of district superintendent, vacated by Mr. Price, will be taken by G. M. Jarvis, with headquarters at Truro, N. S. H. Fleming, late district train despatcher at Moncton, has been appointed chief train despatcher, with headquarters also at Moncton.

Surveys are being made for the proposed Ottawa, Bancroft and Irondale Railway, which is to connect the Ottawa, Arnprior and Parry Sound Railway at Carp, Ont., with the C.P.R. at Almonte, and thence southwest through the iron regions of Lanark and Hastings counties to the G.T.R. at Bancroft.

It appears probable that a railway into the Cariboo country in British Columbia will be built, the line running from the C.P.R., near Ashcroft, to Barkerville.

Considerable progress is being made with the construction of the Baie des Chaleurs railway, and with the preparations to make the port of Paspebiac an ocean terminus. At present the railway is within about three miles of Paspebiac, where the construction of a large pier to stretch out a hundred feet from the bar is being vigorously pushed. It will accommodate vessels of the largest tonnage and have at low water a depth of 36 feet. It will, it is expected, be completed by December, when the railway will also reach Paspebiac.

The Canadian Pacific Railway Co. has under consideration a proposition from interested parties for the construction of the Napierville Junction Railway. This company was incorporated in 1878 by an Act of the Legislature, with power to build a railway from a point in the parish of St. Remi to a point in Napierville with the privilege of extending its line in the county of St. Johns. Between 7 and 8 miles of the road have been constructed. A bonus of $2,500 has been voted by the municipality of St. Edward, $10,000 by the municipality of Napierville, and a subsidy of $3,200 per mile by the Federal Government, and as much by the Local Government.

Although the Government officials who examined the wreck of the railway bridge at Cornwall, Ont., have been very reticent about the matter, it is the general impression that the cause of the disaster was established to be the defective foundation of the piers. Warned by the disaster at the United States end of the Cornwall bridge, the chief engineer of railways and canals has decided to have the foundations of the piers at the Canadian end of the bridge tested by boring. This will determine whether the concrete has properly set under water, and whether the river bottom on which it rests is sufficiently solid to make the foundation of the piers secure.

Regarding the renewal of bridges the semi-annual report of the Grand Trunk Railway says: The president reported to the proprietors, at the last general meeting, that in addition to the reconstruction of the Victoria bridge at Montreal, it had been deemed necessary to the more efficient and economical conduct of the traffic to authorize the renewal during the next two or three years of the bridges on the section of the line between Montreal and Portland, and it has also been determined to renew certain bridges on the southern division used jointly by the Wabash Company. The proportion of the expenditure for reconstruction of the Victoria bridge properly chargeable to revenue has been fixed at £110,000, which together with the cost of renewing the bridges between Montreal and Portland, and on the southern division, it is proposed to charge to revenue account, spread over a period of at least five years, so as to obviate any undue increase in the maintenance charges in any one year. The reconstruction of the Victoria Jubilee Bridge has progressed satisfactorily, and it is expected that the new double track will be available for traffic by the 1st January next. Meanwhile the traffic is being conducted over the single track as heretofore.

The semi-annual report of the directors of the Grand Trunk Railway Company, which was presented at the half-yearly meeting in London, Oct. 13th, showed: Gross receipts for 1898, £1,871,733, as against £1,756,565 for 1897; working expenses were, 1898, £1,243,833; 1897, £1,196,643; leaving a gross profit of £627,850 for 1898, as against £559,923 for 1897. Receipts from subsidiary companies raised the net revenue to £730,672 for the 1898 half-year, compared with £654,395 in 1897. The net revenue charges for the half-year were £624,020, leaving a surplus of £106,651. The directors recommend the payment of the full half-year's dividend on the 4 per cent. guaranteed stock, which will absorb £104,395 17s. 6d., leaving a balance of £2,271 3s. 11d. The result of the past half-year's operations show an improvement of £103,943 5s. 9d. The comparative table of receipts for the half-years ending 30th June, 1898, and 1897, represents for 1898 a decrease of £25,656 in passenger receipts, and an increase for mails and express of £1,752, for freight and live stock of £99,270, and for miscellaneous of £115,168. The net increase is £115,168. The statements show that the Grand Trunk gross receipts for the half year show an increase of £115,168, or 6.56 per cent.; the working expenses, including taxes, an increase of £47,240, or 3.95, and the train mileage an increase of 430,171, or 5.17 per cent.

Marine News.

A dry dock to cost $1,000,000 is talked of at St. John, N.B.

The Montreal & Cornwall Navigation Co. have purchased the steamer Filgate.

The Steamship Pharsalia Co., Ltd., has received a New Brunswick charter; capital, $200,000.

The Government has awarded a contract for a new steel steamer for the P. E. Island service, to a Dundee, Scotland firm.

Clifford Lewis will build another steamer for the Lake of the Woods-Rainy River line. The craft is to be somewhat larger than the Edna Brydges, to carry about forty cabin passengers.

General Manager Gildersleeve, of the Richelieu & Ontario Navigation Co., recently stated that the history of the company during the season beat the record for freedom from accident. No boat had to be retired from active service, and not a single mishap occurred to a passenger.

Lyman J. Rogers, superintendent of the marine railway, Yarmouth, N.S., met with a serious accident by being crushed under a schooner, which was being hauled out for repairs recently.

The most important alteration contemplated by the Richelieu & Ontario Navigation Company in the matter of repairs to steamers will be for the placing of four new boilers in the Quebec.

The Richelieu & Ontario Navigation Company proposes to extend its Lake Ontario service from Toronto next season. The daily steamers between Toronto and Montreal will call at Charlotte, on the American side, both up and down.

Three seventeen knot steamships have been purchased for the Canadian line between Milford Haven and Paspebiac, Que., the first sailing in November. Satisfactory arrangements have been made for a special service of trains between London and Milford Haven.

Louis Lacouture, Sorel; J. O. Blondin, La Baie des Pères, Que.; D. Gillies, M.P.P., Carleton Place, Ont.; James Gillies, Carleton Place, Ont.; John Gillies, Braeside, Ont., have applied for Ontario incorporation as the Lac Temiscamingue Navigation Company, Ltd.; capital, $50,000.

Inventor Knapp, of Prescott, of the roller boat fame, has returned from Chicago, where, he states, he has succeeded in forming a strong company to carry out his roller boat patents. It will be called the Lakes Roller Boat Transportation Co., and will this winter construct a large roller boat 120 feet long. There is no reason, we believe, that if one Ottawa man financed a small roller boat several Chicago men should not finance a large one.

The manager of the Atlantic Transportation Company, W. S. Besse, New York, is buying a fleet of lake vessels for ocean service. The company was organized about a year ago, with a paid-up capital of $3,000,000, with the intention of engaging, on a more elaborate scale than any existing company was doing, in the coal-carrying trade of the Atlantic Coast. A large fleet was secured and now it is being added to by the purchase of nine steamers, at an average cost of $50,000, and thirty-five schooners, at an average cost of $20,000, or a total investment of $1,150,000. The vessels are as follows: Steamers Aragon, Kataloive, Murphy, Moore, Viking, Gettysburg and Lindsay; barges, Bacon, Georgia, Alverston, Crossthwaite, Moonlight, Verona, S. H. Foster, Sheldon and Watson; bought from J. G. Gilchrist & Co.; Redwing, Santiago, Iron State and S. V. L. Watson, bought from Parke & Miller; Wadena, Becker and Ash, bought from W. D. Becker & Co.; O'Neill & Wall, bought from C. R. Jones & Co.; Camden, Massa, Soit, Page, Sage, Milacomet, bought from Drake & Mathan; Fitzpatrick, Brown, McGregor, Parker, Rutter, Porter, Halloran, Helvetia, Wallace, Hawgood, Ewen and Shawnee bought from various companies.

Personal.

A. F Genest, C.E., is now engaged upon work in connection with the Cornwall Canal.

Peter Brass, architect, Hamilton, Ont., has been appointed building inspector of the Grand Trunk Railway.

R. K Oliver, who has been filling the position of C P.R. locomotive foreman at Chapleau, Ont., for some years, has been transferred to Hochelaga.

Town Engineer C. H. Mitchell, of Niagara Falls, Ont., has recently been in Potsdam, N.Y., engaged upon extensive works to generate electric power.

N. R. Carmichael, lecturer in mathematics and electrical engineering in Queen's University, Kingston, Ont., recently married Miss M. A. Jenkins, of Strange, Ont.

Arthur Graham, who has been with the MacGregor-Gourlay Co., Galt; Ont., for some years, has gone to Sherbrooke, Que., to enter the draughting rooms of the Jencks Machine Co.

Mr. Cowles, a locomotive engineer on the Leamington, Ont., division of the M.C.R., and Thomas Reid, foreman of the round house there, have both been sick for some time, and both died on October 8th.

Thomas Jones, for a long time employed with the Yarmouth Steamship Company as a quartermaster, died of typhoid fever, at his home, Jordan Falls, N.S.

W. M. Davis, who for the past thirteen years has been the town engineer of Woodstock, Ont., has been appointed town engineer of Berlin, Ont., at a salary of $1,500 a year.

Miss Myssie Munro, daughter of J. W. Munro, Pembroke, Ont., the well-known contractor, was married recently to Wm. Russel, jr., of the firm of Russel, Poulin & Co., contractors.

R. H. Cushing, C E., has received the appointment of assistant engineer of the I.C.R. His special duties for the present will be to look after the terminal works at St. John, N.B.

Thomas Cowan, postmaster, Galt, Ont., died October 14th at the family residence, near Galt. Deceased was one of the first members of the firm of Cowan & Company, machine manufacturers, Galt.

At a recent meeting of the Ottawa city council a resolution was passed discharging the city engineer, Robert Surtees, the dismissal to take effect on November 30th. The applications for the position are very numerous.

Arch. Blue, of the Ontario Crown Lands Department, recently attended the annual convention of American Institute of Mining Engineers, in Buffalo. While there Mr. Blue delivered an address on "Corundum in Ontario."

Henry Wagner, a moulder employed at Clare Bros.' foundry, Preston, Ont., recently met with a terrible accident. He was carrying a ladle of molten metal and in some manner stumbled, with the result that a quantity of its contents was spilled over his right foot, which was frightfully burned.

Manager Keating, of the Toronto Street Railway Co., who was elected vice-president of the association at last year's session, when he was city engineer of Toronto, accompanied C. H. Rust, C.E., Toronto, to the convention of municipal engineers in Washington, D.C., at the end of last month.

Richard C. Boxall, C E., Sackville, N.B., whose failing health has for some time been the cause of great anxiety to his friends, is now suffering from a mental malady, and all will regret to know that it has been thought best to send him to the Asylum for the Insane at St John, for treatment.

C. H. Sutherland, mechanical engineer of the Grand Trunk Railway, died very suddenly a short time ago. He had been confined to his residence for several days, but no serious results had been apprehended. However, when one of the family went into his bedroom Mr. Sutherland was found dead in his chair. Heart disease is presumed to be the cause of death.

John Duffy, St. John, N.B., foreman of construction work at the new pulp mill at Mispec, while directing work on the roof, fell over to the ground, 40 feet below. He struck a staging in his descent, thus breaking the force of his fall. His arm was injured, several ribs broken, and he also suffered severe internal injuries.

Word was received in Toronto, Oct. 26th by cable of the death in South Africa of Lieut. Keating, son of E. H. Keating, C.E., general manager of the Toronto Railway Company. Lieut. Keating graduated from the Royal Military College, Kingston, in 1888, and joined the 100th regiment, under Col. Trench, lately stationed at Halifax, N.S., and was about three months ago ordered to Africa.

Prof. Alexander Graham Bell, the inventor of the telephone, owns a whole mountain of 1,000 acres in Baddeck, Cape Breton, upon which he has expended a large sum on roads. Upon its southern slope up toward the summit, and overlooking a wide panorama of lake and mountain, he has erected a mansion, and near it a fully equipped laboratory where he conducts his experiments in electricity.

W. H. Aldridge, the manager of the Trail smelter and refiner, the property in British Columbia acquired some time ago by the C.P.R., has recently visited Montreal, and other Eastern centres. Mr. Aldridge took charge of the works at Trail when the property was purchased from the Heinze syndicate, and since that time a great revolution in the works has been effected. The plant is being worked to its fullest capacity.

Dr. Porter, Professor of Mining and Metallurgy in McGill University, Montreal, is back at the University entirely recovered from his recent severe illness. During the summer Dr. Porter has examined the mining areas in Nova Scotia and British Columbia, and is much impressed with the possibilities of mining in both districts. While in British Columbia, Dr. Porter visited East Kootenay and other districts, but was taken ill before he had examined the West Kootenay country. Dr. Porter's many friends are delighted with his complete restoration to health.

ELECTRICAL POWER TRANSMISSIONS.*

BY R. A. ROSS, E.E., M. CAN. SOC. C.E.

(Continued from last issue).

Owing to the copper losses and induction effects at various loads on the system from the generator shaft to the lamps or motors, the generator voltage must be raised as the load increases. It is very desirable that this increase be kept as low as possible, so that a continual adjustment of the voltage be not necessary, rendering the lights unsteady. To this end the copper losses, and especially the induction effects, must be kept within bounds. The first involves only the cost of the copper, the latter depends upon the nature of the demands and the relative positions of the copper conductors. The induction of lines and apparatus has an effect somewhat similar to that of the inertia of water in long pipes, and causes the current to lag behind the voltage, necessitating a large output of volt-amperes to produce watts, and, as lines and apparatus must be of sufficient capacity to carry the useless increase of current and the generator to allow for the useless additional volts, an increased capacity of plant is necessary. These induction effects may have a larger influence on the regulation than the necessary copper losses, and should be carefully watched. It is well to bear in mind, however, that the increased volt-ampere readings do not represent additional power consumption, as would be the case in direct current, as they have to be multiplied by the cosine of the angle of lag (which is always less than unity) to give the true power. Poor regulation therefore cuts down the capacity of the plant, and renders it difficult to maintain the voltage constant under varying loads. Having thus sketched the main points, which affect the general working of the plants, the apparatus may be taken up in detail.

The reducing transformers necessary for lowering the line voltage to that suitable for the incandescent distribution, arc light motors, and rotary transformers for railway service, must be of the highest grade to stand the line potential, as well as the increases of voltage to which they may be subjected under certain conditions. Of course the efficiency should be of the highest and the regulation good. As the heat developed is great, an air blast or circulation of cool oil is provided. The rotary transformers which form such a large part of the load in this case partake both of the nature of alternating motors and of direct current generators. As an alternating current motor of synchronous type they must be self starting, and in consequence are of either two or three phase. As a generator they must at the speed established by the synchronous motor part give the necessary direct current at the proper voltage for the trolley line, as both the motor action and the voltage generation take place in one set of armature windings, and as the fields are common to both, there is a certain ratio of impressed alternating voltage to direct voltage at the commutator, which is constant, and any change of field strength alters the direct current voltage only indirectly by causing a leading or lagging current in the transmission lines, thus giving more or less volts to the alternating side of the machine. Owing to this effect of over or under excitation of the rotary upon the line currents, causing them to lead or lag behind the voltage, this apparatus may be arranged to keep the current and voltage of the line in phase, thus doing away with the troubles from lagging currents which so unfavorably affect the system in the matter of regulation. On the other hand, where there is no necessity for close regulation, the line induction is encouraged, and is found useful in over-compounding the direct current side of the rotary automatically, thus giving the rise of voltage with load so desirable in railway work. In the present case, if the lighting and railway loads be carried upon separate lines, the latter arrangement is desirable, as the lighting will have good regulation while the railway service will over compound automatically. The total load for railway needs being 6,450 E. H. P., and the average from 7 a.m. to 9 p.m. being 3,000 E. H. P., seven units of 1,000 E. H. P. should cover the demands, and the machines in operation should have a good load factor. For the arc light demands as before stated, eight units would be sufficient. The motors may be either synchronous or induction, the former preferably as they may be useful in assisting the regulation of the incandescent lighting service by proper excitation, as their loads do not fluctuate. This apparatus with the necessary switchboard and in-

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

struments for the high potential receiving and lower potential distributing circuits, completes the distributing station equipment.

The line is usually the weakest link in the chain, being exposed to the weather, and not under that careful supervision which is given to the rest of the plant. The pole line as a supporting structure must of course be of the solidest to stand the strains imposed, not only by the weight of copper, but in these latitudes by a great weight of ice also, which if assisted by a gale will try the best work to the utmost. Poles of cedar, pine, or chestnut of very heavy section are necessary for this work. They should be set in concrete or broken stone and heavily guyed on curves, or in certain positions double poles with heavy cross arms between should be used. The insulators for high potential work are universally made of porcelain, as that material weathers better than glass and is not so hygroscopic. This porcelain should be so vitrified as to exhibit a fracture like glass when broken, otherwise it will absorb moisture and break down. To minimize surface leakage, which, if severe, may burn off the pins, the surface over which it has to take place is made as long and of as small surface as possible. To assist in reducing this leakage, insulators with oil in grooves, over the surface of which the leakage must take place, have been tried and found to work well when the oil surface is clean, but in operation dirt accumulates and troubles ensue so that the plain porcelain insulator of large insulating surface and high resistance to piercing is now the standard.

The copper circuits are of bare copper, as weather-proof insulation at high voltages is perfectly useless. The cross section of the copper being of course so proportioned as to give the loss determined upon as suitable for the conditions existing. These conditions depend upon the cost of the power, the amount available and the demands. The loss may be reduced to any extent by the use of more copper, but unless there is a demand for the power saved, which will pay interest and depreciation on the additional cost of circuits, no economy results. On the other hand, the copper may be reduced and the losses increased, but only within the bounds set by the demands of good regulation. In practice a loss of 15% is seldom exceeded, and a very common allowance is from 7% to 10%.

Several effects manifest themselves in alternating lines which do not exist on those of direct current systems, and they deserve the closest attention in planning the system. While the actual losses in direct and alternating work are about the same under the same conditions, the drop in voltage in the former is a measure of that loss, while in the latter it may be no indication. In fact, it is possible to so arrange the circuits in some cases of alternating work as to have a greater voltage at the end of the circuit than is generated at the station, but this does not indicate that the line generates power of itself; it simply means that, while the self-induction and capacity of the line and load raises the voltage, much as a water ram in a pipe line raises the pressure, it at the same time throws the current out of phase with that voltage, and the real power is that obtained by the multiplication of the apparent volt-amperes by the cosine of the angle of lag introduced It is therefore only possible to read the power indications of a Watt-meter, which instrument takes account of this angle while the volt and ampere meter readings which are used to determine direct current power are not reliable for the alternating This increase of voltage may under certain conditions become so serious as to endanger the insulation of line and apparatus. In most cases it is advisable to reduce the induction as much as possible, and to effect this the wires on opposite sides of the circuit are strung as closely together as is consistent with safety, and several wires of equivalent cross section used rather than a smaller number of larger area. To do away with unbalancing of the phases of the system, the circuits should be strung symmetrically, which is effected in the case of two phase lines by placing the going and returning wires of each phase on the opposite ends of the diagonal of a square, and in three phase lines by stringing the three conductors at the corners of an equilateral triangle. As lightning may cause trouble, not only by direct stroke, but by the accumulation of static electricity upon the lines, means must be provided for getting rid of it safely. To this end, guard lines of barbed wire are strung above the circuits, and these are grounded at frequent intervals.

The apparatus in the generating section of the plant consists of the water wheels, generator, raising transformers and switchboard apparatus. Regarding the latter two, the same remarks apply as were made regarding similar apparatus in the distributing station. As to the generators, their size is usually limited by the power of the water wheel units, and their speed by the wheel speed unless gearing be used. The usual method of attacking the question with direct connected units is to arrange for as powerful wheels as is possible consistent with having the proper size units to handle the load properly, and designing the generators properly to suit the wheels as regards size and speed Vertical turbines with the rotating part of the generator revolving in a horizontal plane are usual, but, in several recent plants, horizontal turbines are used direct connected to the generators, which in that case are below the crest of the dam and above the tail-race by an amount determined by the height of the draft tube. The first system introduces footstep bearings, which are always more or less objectionable, but removes the delicate armature windings from chance of damage by water. The second places the generator at the mercy of water-tight bulkheads and stuffing-boxes. As to the voltage to be generated upon the machines, if raising transformers are used, this is of little consequence unless from a machine designer's point of view, as the transformers will have equal efficiency at any ratio of transformation. When the transmission voltage is not dangerously high, it is of course preferable to do away with these transformers, and generate directly on the machine. In deciding this point it must be kept in mind that the failure of a transformer through the breaking down of insulation is a much less serious matter than that of a generator, which is less likely to occur when that apparatus is of low voltage. Owing, however, to improved types of generators, we may expect to see raising transformers dispensed with in many cases where they would have been deemed indispensable with older types.

In specifications drawn up for the generating apparatus, the following points are strongly insisted upon: (1) That the heating of any part shall not exceed a certain specified temperature after a certain length of run at full load and an additional time at a certain specified overload. (2) That the efficiency at full load, three quarters, one half, and one quarter loads, shall be guaranteed by the tenderer and proved by test. (3) That the regulation of the generator shall be within a certain per cent. at full non-inductive load (4) That the insulation of any part of the machine shall not break down under a specified voltage which is high enough to allow of a good factor of safety over the normal pressure. Although it is impossible to specify limits for these requirements which will suit every case, it may be said generally that the allowable increase of temperatures for large generators ranges from thirty to forty degrees centigrade. The full load efficiency from ninety-four to ninety-six per cent. The regulation depends upon whether the machine is compound wound or not. In the former case the regulation may be anything for which the compounding is set, and in the latter from three to ten per cent. The test voltage applied ranges from three to ten times the operative, the former factor for high voltage machines, the latter for lower voltages. The modern generator being either of the inductor, or revolving field type, in which the high potential armature windings are stationary, lends itself to high voltage generation, as the insulation spaces may be increased largely without rendering the machines unwieldy, for the reason that the armature wires are distributed over the outside ring where space is more abundant, and the vibration of running, which abrades, and finally breaks down the insulation on the older revolving armature types is largely absent in the newer machines.

(To be continued.)

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Quebec, September 24th, 1898.