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The Canadian Engineer

ESTABLISHED 1893

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TORONTO, CANADA, SEPTEMBER 6th, 1907.

CONTENTS OF THIS ISSUE.

THE QUEBEC BRIDGE COLLAPSE.

On another page is given a detailed description of the collapse of what was to have been the largest bridge in the world. Up to last Thursday the work on the steel superstructure had proceeded very favorably, and in a few seconds of time the completed portion of the bridge was no more, and coupled with the collapse of this immense structure, upon which the eyes of engineers the world over were fixed, there was an appalling loss of life.

It is too early to be able to say what the cause was, but it is evident that some one has blundered. Many bridge experts have passed their opinion on the design as being quite satisfactory, and although a bridge of this span has never before been built, the data designers have to be guided by, are sufficient to enable them to make their calculation practically perfect. There are many things that would cause a structure of this kind to collapse besides faulty design, viz.; poor material, careless workmanship, faulty erection, and possibly the removal of the false work at too early a stage. One of these was undoubtedly the cause of the terrible disaster. At this stage it is too early to say which. We only know that the work already completed is no more, and the lives of between 80 and 90 workmen have been sacrificed.

Nothing will be left undone to find out the cause. If the design is at fault it will be laid aside. If the workmanship was not up to standard then the builders should be made to pay the penalty. In any case the blame for the downfall should be brought home to the party or parties who were the cause of it.

To say that the undertaking is impossible would be unsafe, since it would almost seem that nothing is impossible to the engineer of to-day. One thing is certain, there is a limit of length to which a single span may be built with safety, and it is just possible that in this case the limit has been more than reached.

If poor workmanship or the method of erection was the cause it is more than likely that the particular fault will never be found, but if on the other hand the design was wrong it will be an easy matter to place the blame. It appears that a number of changes have been made since the original design was prepared, and it is not unlikely that the error in calculation, if there was one, was made when the changes were in progress, and as every engineer well knows, one mis-step in the calculations, or the placing of one weak member, would mean the collapse of the whole.

There is only one consolatory thing in the whole affair, and that is that the collapse came when it did. Had the defective portion held until the bridge was completed, at some time when the bridge was carrying more or less of an overload it would have gone down, and the loss of life would have been considerably greater, to say nothing of the increased financial loss.

If it is possible to build a bridge with a single span of 1,800 ft., the Quebec Bridge will be built, but before another attempt is made the present design should be checked from beginning to end, and positive proof given that it will be absolutely safe. If the design is defective

it should be completely discarded, not patched up. We are well aware that there is more or less uncertainty about a new engineering venture, but the results of the investigation will be a guide to the engineers in their future work and they should know positively what the results will be before the undertaking is again attempted.

PEAT FUEL.

The use of peat for fuel purposes is by no means a new question. Years ago it was put on the market in competition with firewood. At that time it was merely cut out of the bog in pieces of suitable size, and these were dried and placed on the market. As a fuel it was satisfactory, but the industry proved unprofitable, and was not carried on for long.

Since that time many persons have tried to manufacture peat fuel, with the object of increasing its fuel value. These investigations have proved successful, but as yet there has been very little development in this country. Several companies have tried to place this fuel on the market, but they have been almost complete failures, largely on account of the prohibitive cost of manufacture. A fuel was produced very much similar to hard coal. It was easy to burn and was of high calorific value. There is no doubt that if the manufacture had been put on a commercial basis, the demand would have given rise to a big industry.

Peat is the decayed matter which comprises many old bogs, viz.: all the dead material that is to be found in a forest swamp; roots, leaves, fibres, moss, etc. It will be readily understood that this matter when dried makes an excellent fuel.

Now that the price of the commoner fuels, coal and wood, has increased considerably, it is highly desirable that a fuel of equal quality and lower price be placed on the market. Peat can be made use of in this connection. It remains for some one to devise a not too costly and easy method of preparing it.

This fuel is being successfully manufactured at a moderate cost in several European countries, notably Holland, Norway, Sweden, Denmark, Finland and Germany. There seems to be no good reason why the immense peat bogs that are spread over Canada, could not be made use of.

At the present time a representative of the Canadian Government is in Europe making a study of the plants in operation, and of the peat industry generally. Upon his return he will act as Government expert on peat, giving assistance to manufacturers when called upon.

The report when published will be a valuable addition to the literature published by the Government. It will be of interest not only to those interested in the peat fuel industry, but to the public generally, particularly to those in parts of the country remote from the various sources of coal supply, since the question of fuel is one that no one in this country can avoid. Even those who would not find it advantageous to use peat would be indirectly benefitted. The industry on a large scale would give employment to many, and money spent for fuel, would be spent at home.

In the West the need of a new fuel is keenly felt. In the winter time it is very often impossible to transport coal over the railways, and the forests are being constantly depleted, with the result that wood for fuel purposes is becoming very scarce. Only last winter was given an example of what the fuel question in the West is, and as that portion of the country becomes more thickly settled the problem will become more vexed.

Some of the finest peat bogs in the world are distributed throughout the Dominion. It is estimated that there are about 37,008 square miles, the average depth of the bogs being from eight to ten feet. It is not unlikely that further investigation will add considerably to this figure.

Careful tests have shown that the heat value of 1.8 tons of peat is equal to one ton of coal, or 2.5 tons of wood.

As well as being useful as a fuel only there are many other uses to which peat may be put. It is now being used in the making of producer gas. At the present time a company is being organized to utilize some of the immense peat bogs of Ireland to supply gas for power and lighting purposes to the city of Dublin. Peat is also being used in the manufacture of alcohol, and it is stated that this can be produced at six cents per gallon. One of its uses from which Canadians will reap much benefit, is in the electric furnace. As in the ordinary blast furnace, a reducing agent is required in the electric furnace, and it has been found that peat makes an excellent reducing agent. In many places in Canada where iron ore is found peat bogs are in close proximity. The installation of a plant to prepare it, would give the electric furnace a constant and unfailing supply of the necessary reducing agent.

If this question is considered as carefully in Canada as it has been elsewhere, in a few years the industry should be a leading one in this country.

EDITORIAL NOTES.

The results of the innovation of twelve gasoline railway motor cars on the Union Pacific will be watched with considerable interest by the engineering public. These cars will be placed upon branch lines, where fast service is not required. They have the advantage of starting and stopping quickly, and the speed attainable, enables the company to give a much more frequent service than would otherwise be possible. The latest type will be a 200 horse-power engine capable of attaining a speed of sixty miles an hour.

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It is pleasing to note that at least one Canadian city is adopting a policy in connection with its engineering department which should be an example to some of the older ones. The City Council of Victoria, B.C., has decided to have all the electric light and telephone wires placed underground before the streets are repaved. Good pavements are more or less expensive, as the tax-payers well know, and if those who have charge of the work in the cities and towns would only look far enough ahead they would avoid the expense of tearing up new pavements for purposes such as that already mentioned, at the same time making it unnecessary to pave streets the second time within a very short while. The people of Victoria are to be congratulated in having a council that is looking after their interests in such a practical manner.

MARKET CONDITIONS.

Montreal, September 5th, 1907.

American pig iron markets are stagnant this week. Sales of moderate quantities have developed at a reduction of 50 cents to $1 per ton, but whether this a fair indication of general market conditions or not is a question. Demand is very slow and the volume of metal changing hands is very small.

The English markets are steady, with a good demand, for the most part. There has been little change during the

week, save that the scarcity of strictly No. 1 iron metal is becoming more marked. Fully 6 shillings more, per ton, is now being obtained for No. 1 Cleveland than for No. 3, as against the customary difference of 1s. 6d. This also applies to the Scotch market where furnaces have been working badly and highest grades of metal have become very scarce. Prices of both English and Scotch are well maintained, no reduction in price being obtainable, save in the case of orders aggregating 1,000 tons and upwards.

In the local market, the demand is excellent. As a matter of fact, it is better than at any time during the present year. A large number of enquiries are being received daily and one firm, alone, reports negotiations during the past few days for business aggregating 6,000 tons. Nor is this business ending in enquiry, practically all of it developing into orders. The demand is for metal to arrive here during the months of October and November. The material is intended to cover early requirements, and also for stock during the winter months. Latest advices would indicate little probability of reduction in the price of British metal for at least three or four months to come, but neither producers nor merchants seem to care to express any decided opinion about what may happen after that time.

Antimony.—No change has taken place during the week, prices being still 14½ to 15c. per pound.

Bar Iron and Steel.—The market is steady and active. Quotations are:—Bar iron, $2.20 per 100 pounds; best refined horseshoe iron, $2.60, and forged iron, $2.45; mild steel, $2.25 per 100 pounds; sleigh shoe steel, $2.25 for 1 x ⅜-base; tire steel, $2.40 for 1 x ⅜-base; toe calk steel, $3.05; machine steel; iron finish, $2.40; base and reeled, $2.85.

Boiler Tubes.—Trade is active and prices are steady. Quotations are: 2-in., 8 to 8½c.; 2½-in., 10¼ to 10¾c.; 3-in., 12c.; 3½in., 15 to 15¼c.; 4-in., 19¼ to 19½c.

Cement—Canadian and American.—The output for the year is practically sold up. Canadian prices are steady at $1.90 to $2 per barrel, in cotton bags, and $2.20 to $2.30 in wood, weights in both cases, 350 pounds. There are four bags of 87½ pounds each, net, to a barrel, and 10 cents must be added to the above prices for each bag. Bags in good condition are purchased at 10c. each. Where paper bags are wanted instead of cotton, the charge is 2½ cents for each, or 10 cents per barrel weight. American cement is steady at $1.10 per 350 pounds, basis Lehigh mills, conditions being the same as in the case of Canadian mills, save that when the cotton bags are returned in good condition, only 7½ cents is allowed for them.

Cement.—English and European.—English cement is unchanged at $1.80 to $1.90 per barrel in jute sacks of 82½ pounds each (including price of sacks), and $2.10 to $2.20 in wood, per 350 pounds, gross. Belgian cement is quoted at $1.75 to $1.90 per barrel, in wood. German is $2.52 to $2.55 per barrel of 400 pounds for Dyckerhoff.

Copper.—The market has held steady during the week, prices being still 23 to 23½c. per pound.

Iron.—The local market is more active than it has been at any other time this year, orders being now received for fall delivery. Extreme prices on Summerlee and on Clarence have been withdrawn and purchases may be made at the inside figures without difficulty. Lower grades of iron are in all cases available at a wider range below finer, than usual. Londonderry is only offering for future shipment, and is quoted at $24, f.o.b. Montreal, for No. 1. Toronto prices are about $1.25 more. Summerlee iron is arriving, and is quoted at $23.50, f.o.b. on cars, Montreal, for No. 2 selected, and $25 for No. 1. No. 1 Cleveland is quoted at $21 on cars, Montreal and Clarence at $19.50.

Lead.—Prices of lead show no change, being $5.25 to $5.35 per 100 pounds.

Nails.—Demand is active and prices steady. Quotations are $2.50 for cut and $2.55 for wire, base prices.

Pipe—Cast Iron.—Prices are firm at $37 for 6-in. pipe, $38 for 5-in., and $39 for 4-in., at the foundry. Gas pipe is quoted at about $1 more than the above.

Pipe, Wrought.—Demand is good and prices steady. Quotations and discounts for small lots, screwed and coupled, are as follows: ¼-inch to ⅜-inch, $5.50, with 57 per cent. off for black and 42 per cent. off for galvanized. The discount on the following is 66 per cent. off for black and 56 per cent. off for galvanized: ½-inch, $8.50; 1-inch, $16.50; 1¼-inch, $22.50; 1½-inch, $27; 2-inch, $36; and 3-inch, $75.50.

Steel Shafting.—Demand for steel shafting keeps up well, and prices hold unchanged, 30 per cent. off the list being still the discount.

Steel Plates.—There is a good demand for all that can be obtained. Prices hold steady, for small lots, at $2.75 for 3-16 and ⅛ and $2.50 for ¼ and thicker.

Spikes.—Railway spikes are quoted at $2.75 per 100 pounds, base of 5½ x 9-16. Ship spikes are steady at $3.15 per 100 pounds, base of ⅝ x 10 inch and ⅝ x 12 inch.

Tin.—Dealers still quote 44 to 44½c. per pound, notwithstanding that the demand is a little disappointing.

Tool Steel.—The situation is fairly active and firm. Base prices are as follows: Jessop's best unannealed, 14½c. per pound, annealed being 15½c.; second grade, 8½c., and high speed, "Ark," 60c., and "Novo," 65c.; "Conqueror," 55 to 60c.; Sanderson Bros. and Newbould's "Saben," high speed, 60c.; extra cast tool steel, 14c., and "Colorado" cast tool steel, 8c., base prices.

Zinc.—Prices hold steady at 6¾ to 7c. per pound.

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Toronto, September 5th, 1907.

Purchasing of metals, dealers tell us, is of the hand-to-mouth variety; and then, besides, there has been a gradual recession in prices of most metals. The lessened activity is in part accounted for by this being the slack time of the year; but it is also to be remembered that the declines increase the timidity of buyers. Lead, tin, copper and antimony are all quoted lower. Among iron and steel goods the stock of small sizes of boiler tubes has been restored and the supply is now fair all over the list. Last week's remarks upon wrought steam and water pipe will still apply.

Old Country advices during August have been that quantities of pig iron were moving out of store, both Scotch and Cleveland. At 23rd August the stock of Scotch was down to 1,966 tons, and of No. 3 Cleveland to 184,136 tons, where at 1st January it had been 517,386 tons. Cash price of warrants went up from 56s. 9d. on 19th to 57s. 1½d. on 22nd, falling back to 56s. 7½d. for buyers' of Cleveland on 23rd. Business light in Scotch, but very active in Cleveland iron.

The British Board of Trade returns show the iron and steel exports from the United Kingdom in seven months ended with July was 3,280,188 tons in 1907; 2,627,597 tons in 1906; 2,191,299 tons in 1905. This includes pig iron, railway steel, and manufactures of both. Imports of iron and steel on the contrary show a decline.

Among structural materials cement continues active, with a fairly good supply to be depended upon. Common bricks move freely and the red and buff pressed brick are in constant request. Terra cotta fire-proofing, which is now produced in both Toronto and Montreal, is in growing favor for modern first-class buildings. It is impossible to specify prices of this material, so miscellaneous are the shapes and sizes of it.

American-Bessemer Sheet Steel.—14-gauge, $2.70; 17, 18, and 20 gauge, $2.80; 22 and 24 gauge, $2.90; 26 gauge, $3; 28 gauge, $3.25.

Antimony.—The market has declined. Cookson's now quotes $13.

Bar Iron.—$2.30, base, from stock to the wholesale dealer.

Boiler Heads.—25c. per 100 pounds advance on boiler plate.

Boiler Plates.—¼-inch and heavier, $2.50. But a poor supply on hand here; prices are firm, with, however, no advance.

Boiler Tubes.—Lap-welded steel, 1¼-in., 10c.; 1½-in., 9c. per foot; 2-in., $9.10; 2¼-in., $10.85; 2½-in., $12; 3-in., $13.50; 3½-in., $16.75; 4-in., $21 per 100 feet, in fair supply at unchanged prices.

Bricks.—Common structural $10 per thousand. In steady demand. Red and buff pressed, at Don Valley works, $18 per 1,000, and moving freely.

Cement.—Star brand, $1.95 per barrel, f.o.b., Kingston, National, $1.95 per barrel, Toronto, in car lots; retail price, $2.15; English, Anchor, $3 per barrel in wood.

Fire Bricks.—In steady request; English, $32 to $35; Scotch, $30 to $35; American, $25 to $40 per 1,000.

Ingot Copper.—Quiet and with a downward tendency, Toronto price; Lake, 23c.; casting, 20 and 21c.

Lead.—Demand less strong; goods scarce for immediate delivery; $5.35 for pig.

Nails.—Wire, $2.55 base; cut, $2.75; spikes, $2.75. A fair supply on hand; prices steady.

Pig Iron.—Summerlee No. 1, to arrive, steadily in demand but hard to obtain, still quotes, nominally, $27; No. 2, $26; Cleveland, No. 1, $23.50, $24; Clarence, No. 3, not obtainable, but worth $24.

Steel Rails.—80-lb., $35 to $38 per ton. Steel beams, channels and angles, 2¾ to 3c. per pound.

Sheet Steel.—Firm, 10 gauge, $2.70; 12 gauge, $2.80; in moderate supply.

Tank Plate.—3-16 in., $2.65; Tees, $2.90 to $3 per 100 pounds; angles, 1¼ by 3-16 and larger, $2.75 to $3.

Tin.—Visible supply reduced, goods scarce and strongly held; 41 to 42c. for pig, and firm.

Tool Steel.—Jowitt's special pink label, 10½c. per pound; Capital, 12c.; Conqueror, highspeed, 70c. base.

Wrought Steam and Water Pipe.—Trade prices per 100 feet are: Black, ¼ and ⅜-in., $2.37; ½-in., $2.89; ¾-in., $3.90; 1-in., $5.60; 1¼-in., $7.65; 1½-in., $9.18; 2-in., $12.24; 2½-in., $20.10; 3-in., $26.40. Galvanized, ¼ and ⅜-in., $3.19; ½-in., $3.74; ¾-in., $5.06; 1-in., $7.26; 1¼-in., $9.90; 1½-in., $11.88; 2-in., $15.84; 3½-in., black, $34.20; 4-in., $38.85. Supplies are inadequate and the demand good. All quotations are firmly held.

Zinc.—Sheet zinc, a moderate business doing at steady prices. Toronto, slab, $6.25; sheet, $8.

BOOK REVIEWS.

Coal Mining.—Part I.—By Daniel Burns, member of the Institute of Mining Engineers, and lecturer in mining at the Glasgow Technical College, and George L. Kerr, member of the Institute of Mining Engineers. London: Whittaker and Company. Price, 2s. net; pp. 102.

This book is specially written for mining students and others who are deterred from purchasing the best existing works on account of their cost. Recognizing that it is impossible to issue a comprehensive treatise on this broad subject at a low price, it is believed that an issue in parts may to some extent overcome the difficulty, and enable many persons to gradually become possessors of a work that covers the ground thoroughly. With this end in view, the publication of this work in sections has been arranged for. Owing to there being practically no limit to the range of subjects connected with mining, the authors have had to assume an acquaintance on the part of the reader with many subsidiary subjects. This part will be found suitable, not only for students of mining, but also useful to the colliery manager and mining engineer, as work of reference. The work should prove of exceptional educational value, and should be a valuable aid to engineers interested in coal mining. The complete work will cover all the more important operations connected with coal mining in England, as well as the recent advances that have been made in its different branches.

Balancing of Engines.—By Archibald Sharp. London: Longmans, Green & Company, 39 Paternoster Row. Price 6s. net, pp. 207.

The subject of engine balancing is receiving more attention from engineers than, perhaps, ever before, due, no doubt, to the rapid development of gas engines, and the successful installation of steam turbines for land and marine use. Good balance of the inertia forces of the engine forms the subject matter of this work. With the exception of a few analytical investigations, the method of treatment is graphical. The engineering student will recognize many geometrical methods with which he is familiar, as applied to Statics of Structures. Much of this subject matter is published for the first time. A series of exercises, with answers in some cases, is appended at the end of most of the chapters, some of these being taken from papers set at the qualifying examinations of the Institute of Civil Engineers. A synopsis at the end of the volume presents, in a form convenient for easy reference, the inertia properties of most of the types of engines in actual use. This work will prove a valuable aid to either steam or gas engineers, and will be found useful to students, draftsmen, designers, and buyers of engines.

* * * *

Glues and Gelatines.—By R. Livingston Fernbach. London: Archibald Constable and Co., Limited. Size 5½ x 8, pp. 298. Price 10s. 6d.

A practical treatise on testing and examination of glues and gelatines is given in this work, and although it is published in England, it deals with American practice since the author is an American. In order that the commercial value of glue may be determined, it is necessary to test it, since testing is the only means by which the manufacturer is able to grade and put the prices on his product. The testing of glue is a subject that has been given very little consideration by writers, only brief references being made to methods which are obsolete. A study of this book will not enable the manufacturer to make a better product, as the author says: "To afford the uninitiated consumer a rational means of protection is the chief aim of this work."

The book also offers to chemists test methods which will enable them to determine the value of glue for specific purposes rather than merely defining its abstract chemical characteristics. The author does not go deeply into a discussion of the probable constitution of glutin or gelatine and allied substances, nor does he describe the chemical changes undergone by the glue yielding materials, and the course of manufacture. These principles are mere opinions and have yet to be substantiated in actual practice. They have no bearing whatever upon the fitness or unfitness of the glue for a given purpose, nor do they aid either chemist or consumer in deciding which of the glues is the better.

Of course manufacturing processes leave certain clues in the finished product that make it possible to determine to a certain extent the commercial value of the glue, but very few consumers know anything of the process, and consequently have to take the word of the salesmen as to the quality of the material they are purchasing. Over 50,000,000 pounds of glue, both foreign and domestic, are used in the United States yearly, and while the quantity used is considered, very few know anything of the properties of this valuable material. Mr. Fernbach is of the opinion that the day is not far distant when glue and gelatine will be purchased on specification. Readers of this book will be well prepared when such a time comes.

The first chapter, as usual, is introductory, and deals with the nature and properties of glue, sources of glue, principles of manufacture, etc. The following chapters set forth the analysis of glue and gelatines; substitutes for glue and gelatine; foreign glues; selection of glues; how to use glue; trade conditions affecting the price of glue; position of the jobber in the trade, etc.; recipes for the mixing of special glues and cements; analytical methods, and an appendix of valuable data for users of glue.

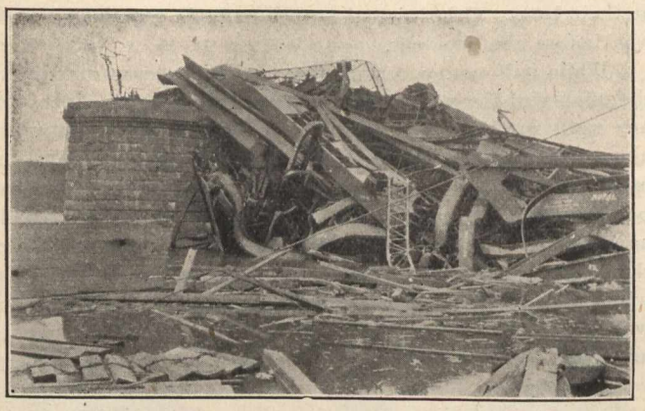
THE QUEBEC BRIDGE DISASTER.

[By a member of our own staff, who visited the scene of the wreck.]

For the benefit of those readers who are not familiar with previous descriptive articles of the "Quebec Bridge" that have appeared in the Canadian Engineer, the following particulars of the bridge are given:—

Dimensions of the Bridge.

The dimensions and points of interest of the bridge are as follows:



Main Pier and Steel Work Adjacent.

Type of bridge, cantilever.

Total length of bridge between abutments, 3,220 feet.

Consists of: two deck truss approach spans, each 210 feet long; two anchor arms, each 500 feet; two cantilever arms, each 562½ feet long, one suspended span, 675 feet long, the longest single truss span ever built.

Central span, centre to centre of main piers, 1,800 feet, the longest in the world.

Type of trusses, pin-connected.

Width, centre to centre of trusses, 67 feet.

Depth of trusses varies from 97 feet at the portals to 315 feet over main piers.

Clear headway over high tide, 150 feet, for a width of 1,200 feet.

Height of peaks of main posts above the river, 400 feet.

Capacity, two railway and two electric railway tracks, two roadways and two footwalks, all on same level.

Total weight of steel in bridge, 38,500 tons.

Weight of heaviest single pieces handled, 100 tons.

Longest single section shipped to bridge site, 105 feet.

Eyebars, the largest yet used, with a maximum of 56 on one pin.

Diameters of pins from 9 to 24 inches, and up to 10 feet in length.

Total number of field rivets to drive, about 550,000.

Type of traveller used for erecting anchor and cantilever arm trusses, gountry, running outside of trusses, on tracks at about floor level, and spanning highest point of bridge.

Weight of gountry traveller, fully rigged, with all accessories, 1,000 tons.

Steel wire cable on traveller, seven miles of seven-eighth.

Manilla rope on traveller, 13 miles of one-inch, one and one-half inch, one and three-quarter inch, and two-inch.

Grade of one per cent. on each end, connected at centre by vertical curve, 1,125 feet long.

Most complicated shop work was on the main pier shoes, the detailed drawing for which took one draughtsman six months to make. These shoes weigh 73¾ tons each.

Main piers built of concrete, faced with massive, rock-faced granite, were sunk with pneumatic caissons 150 by 49 feet, and 25 feet high. The tops of these piers measure 133 by 30 feet, and they contain 35,000 cubic yards of masonry.

Anchor piers, built of concrete, faced with granite, are 30 by 111 feet at the base, 56 feet high from bottom of anchorage metal, measure 24 feet by 105 feet at the coping, and contain 14,400 cubic yards of masonry.

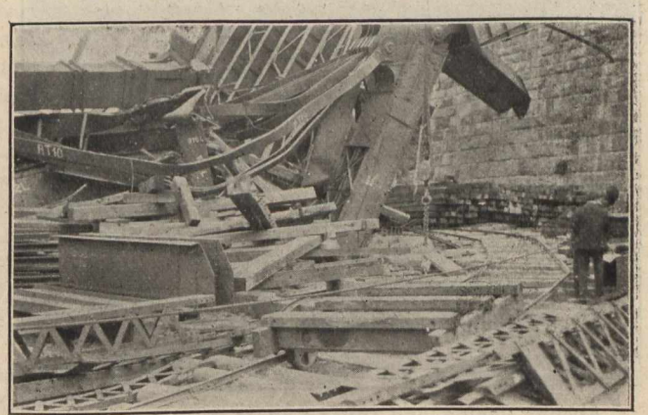
Abutments, built of concrete, faced with granite, are 80 feet wide, 40 feet deep, and contain 4,000 cubic yards of masonry.

The Disaster.

On the evening of August 29th the enormous structure, known as the Quebec Bridge, collapsed, and in less than half a minute the work of two years was annihilated. The section which collapsed was the anchor arm, cantilever arm and a portion of the suspended span which had been built from the south bank of the St. Lawrence River outwards to join the portion being erected on the north bank of the river. It was estimated that the total weight of the bridge, when completed, would be 40,000 tons, and practically, 16,000 tons may now be seen, stretching from the anchor arm outwards to the river pier, a tangled mass of ruins. Engineers on the spot declare that never in the history of the world was such a sight of massive, twisted and crumpled steel structural work seen before. Upwards of seventy lives and two millions of dollars is the toll.

The collapse occurred, so far as can be authenticated, without any warning. Several statements have been made regarding warnings, and one, credited to Theodore Cooper, the consulting engineer of the Phoenix Bridge Company, the builders of the bridge, has been wholly or in part repudiated. At 5.35 p.m., shortly before the workmen were to have quit work, the bridge went down with a grind and a roar, and in less than 30 seconds nothing was left standing of the enormous structure, save the approach span.

Any casual attempt to arrive at the cause of the accident would be futile, and even a thorough investigation may not be productive of certainty in this respect. However, the Government has appointed a commission of able engineers to attempt this purpose. The commission consists of Professors J. G. G. Kerry and J. T. Galbraith, of Toronto, and Mr. Henry Holgate, C.E., consulting engineer, of Montreal. The latter commissioner was on the ground when the representative of the Canadian Engineer visited the bridge, and it was through Mr. Holgate that the information contained herein was obtained. The commission is working in harmony with the bridge engineers by whose assistance various main members have been located in the wreckage and plainly numbered in order that their present position may be traced from that which they occupied in the structure.

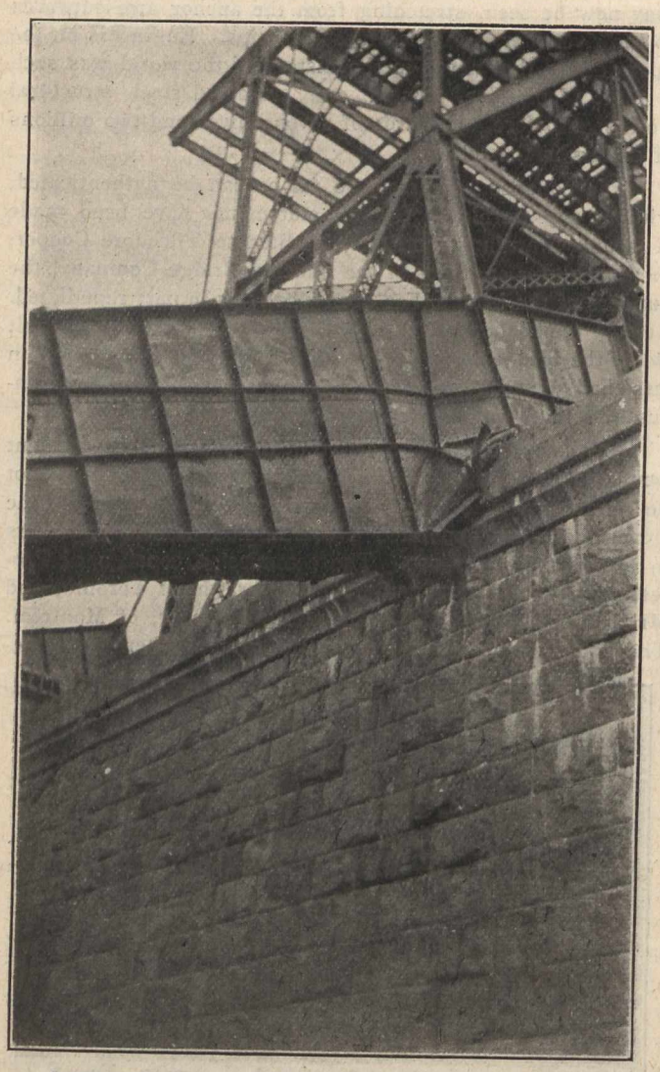


Anchor Arm.

General Appearance.

Not the least astonishing feature to be noted by the careful observer is the manner in which the bridge seems to have fallen. On the up-river side, the position of the steel on the ground does not seem to have anywhere fallen more than about six feet out of the vertical. On the down-river side, the steel may be found possibly twenty feet out of posi-

tion, at certain points, but for the most part the drop has been almost vertical. Apparently, there was no connection between the anchor arm and the approach span other than that afforded by the steel rails of the railway track. These were pulled out of the anchor arm portion and are now hanging over the edge of the approach span and swaying over the anchor pier as the wind blows upon them. Standing on the anchor pier, one has rising up behind him the approach span, uninjured and apparently not even scratched. In front is the line of wreckage stretching out to the river pier. Beyond the river pier, little is to be seen, the water being so deep as to swallow up the structural work of the cantilever arm and the portion of the suspended span without leaving any trace of it or even endangering navigation. Running along the top of the scrap heap from the anchor pier to the river pier, can be easily traced two lines of top chord eye bars, connected together save for an occasional outside bar. So far as could be seen, the bars which were twisted off the pins were on the right hand side. These bars lie upon a confused mass of wreckage. Immediately in front of the



Anchor Casing and Outer End of Approach Span.

anchor pier is the portal, with its two tubular columns toppled over, and their summits resting on the ground. Out at the river pier, all is confusion save the down-stream main tower. This fell with its top pointing towards the river and its foot kicked back towards the anchor pier. The outer end appears above the water, the foot being lost in the mass of wreckage which rests on the ground. It is noteworthy that had any one been on the top of the anchor pier during the accident, or had he stood only a few feet from under the bridge, he would have escaped injury. The inclination of the fall was slightly down-stream, the uprights being apparently mostly bent over in that direction.

Where the Failure Did Not Occur.

While it is not possible to say as yet at what point the failure occurred, it is possible to mention several important points where it did not occur. It has frequently been asked if the piers had not in some way become damaged or the anchorage failed. An investigation shows most certainly that neither of these is responsible for the mishap. The piers are of concrete, faced with granite, and an examination shows these to be in perfect condition. Where the heavy members fell across the piers, the coping is slightly chipped, though hardly as much as if struck sharply with a hammer. The weight of the downward pull of the members, however, crumpled the steel as if it had been paper, where it came in contact with the granite pier. The anchorage is perfect. The eye bars constituting the anchorage, after coming up out of the pier, were carried upwards in two tapering steel pillars or shells. When these pillars were forced forward over the edge of the pier they bent necessarily the eye bars at their base. Otherwise the anchorage is practically as it was before the accident.

While it is not so certain that the failure was not due to the quality of the steel members, utter absence of evidence of any fault in these, as they lie in the scrap heap, would almost justify the assumption. Everything points to the excellence of the material used. The top chord eye bars can be seen from one pier to the other, lying along the wreckage. None of these show any indication of damage other than the twisting and bending incident to the wreck. Nowhere was found an eye bar which had failed, though one was spoken of. One exception, however, is of no importance, and neither is the fact that a number have been warped off the pins. Several bottom chord splices have failed, in some cases by tearing the splice plates and others by shearing the rivets. Many of the main posts are bent back upon themselves to an angle of 180 degrees. In the construction of these, channel sections made up of four to eight webs and four heavy angles, were used. During the process of buckling, the rivets holding these together were shorn off in large numbers. In some places, the area so shorn must have contained upwards of 500 rivets—one engineer placed the number at 1,000—not one of the rivets being left. Even the fractures in the field rivets showed good workmanship and an excellent quality of metal was indicated. In some of the built members, the angles were snapped off short, the same members, however, showing at other points no flaw, notwithstanding that they were bent and twisted into every imaginable shape. The fractures could be easily accounted for by the sudden shock to which they were subjected.

The workmanship also gave every indication of excellence. Not an engineer visiting the wreck had any criticism to offer on this point, all allowing that it was admirable.

Design.

Inasmuch as nothing in the foregoing would seem to warrant further attention at the moment, the question of design may be considered. The bridge was designed by Henry Szlapka. It was to have been the longest single span bridge in the world. Its main dimensions were: length of anchor arm, 500 feet; cantilever arms, 562 feet 6 inches; suspended span 675 feet; approach spans, 210 feet; height to top of main towers, 414 feet; clearance above high water, 150 feet; distance centre to centre of trusses, 67 feet; depth of trusses at ends of anchor and cantilever arms, 97 feet; depth over main piers 350 feet; weight of metal, 40,000 tons.

Only those who have had a wide and varied experience in bridge building are in a position to offer any criticism regarding the design. This bridge was constructed on a scale heretofore never attempted. Under these circumstances, although the science of structural engineering is often considered an exact one, the undertaking must be considered largely in the nature of an experiment. It was noticeable that the lattice bars, in many of the large compression members, although in reality heavy, were relatively light. This feature was commented upon by several of the engineers on the ground, although none would go so far as to say this had anything to do with the failure.

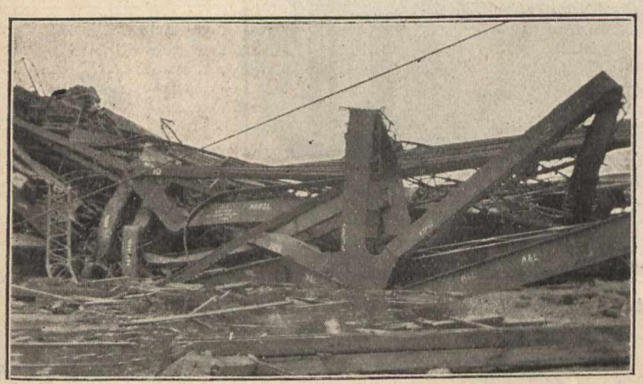
A failure in the anchor arm would cause the cantilever arm to drop into the river much as actually took place, while a failure in the cantilever arm would inevitably wreck the anchor arm as well, by relieving the tension on the top

chords and throwing upon them a compression which they are not designed to carry. So that the wreck, as it stands, might have reasonably been caused by a failure of either section.

Conditions at Time of Accident.

At the time of the accident, the work had got to the fourth panel from the south end of the suspended span. A large traveller, weighing 1,000 tons, stood at the end of the cantilever span. It had been dismantled of about one-third of its weight, so that, in this respect, there was less weight upon the bridge than there had been upon previous occasions. This reduction in weight, however, was probably more than made up for by an enormous amount of structural material piled out on the end of the suspended span. Near by was the small crane, weighing about 200 tons. As the accident, from all accounts, occurred at the moment that a locomotive, with two cars moved out to the suspended span, this must be regarded as the proverbial straw which broke the camel's back.

It is interesting to note that the bridge sank with a grinding sound, rather than dropped with a succession of reports. This tends to indicate that failure of compression rather than tension members was the initial cause.



Anchor Arm, Third Panel Point from Main Pier.

The length of time required for the fall is attested to with reasonable accuracy by the experience of the time-keeper. This man was some 250 feet out on the anchor arm when he felt a movement. He immediately started for the bank. He succeeded in reaching the approach span before the anchor arm had parted appreciably from it. The time would therefore be in the vicinity of 12 seconds.

Under the circumstances no member could have been subjected to anything like the pressure which, having due regard to the factor of safety employed, it should be expected to bear without failure. It is a matter of congratulation that the failure occurred now instead of later, when the monetary loss would have been greater and the loss of life might have been too terrible to contemplate.

It is of the utmost importance that no time and expense is spared to arrive at a definite conclusion as to the cause of the accident. Failing this, the question of restoring the bridge will be viewed with apprehension by the public and will present uncertainties to engineers which few will care to accept the responsibility of. The Government is apparently alive to this phase of the question and is still determined to carry out the work of bridging the St. Lawrence.

As to the heap of steel below the bridge, it is no less a problem to know what to do with it. It will entail an enormous amount of work to remove it. The general impression is that it will remain where it is long after the present generation has passed away as a monument to the first Quebec Bridge.

WIRE WOUND WOOD PIPE.

One of the most important British Columbian industries is the manufacture of wooden pipe for waterworks systems. Wooden pipe is by no means a new thing. Years ago logs were bored out and used for the conveyance of water, and for more than twenty years wooden pipe has been manufactured in the United States. However, it is comparatively a new industry in Canada, wooden pipe having been manufactured for the first time in British Columbia about four years ago, the first factory being located at Vancouver. There are now three companies in British Columbia, two in Vancouver, and one in New Westminster, the latter being the Dominion Wood Pipe Company, Limited, which company commenced operations about a year ago. The pipe manufactured by this company is of an entirely new type. The company controls a new patent process of winding the pipe with wire, their method being to use two independent strands of wire instead of one, which it is said gives additional strength to the pipe, since if one wire breaks the other will keep the pipe from bursting. The plant of the Dominion Pipe Company occupies five buildings, the factory, the power house, the dry kiln, the warehouse, and the office. The factory building is 68 ft. x 138 ft., and is equipped with the most modern machinery for the manufacture of the company's product. The power house is 28 x 32 ft., the dry kiln 24 x 70 ft., with a capacity for 10,000 feet of lumber per day. This kiln was installed by the North Coast Dry Kiln Company, of Seattle, Wash., and it is a special feature of the company's equipment. Altogether the company's plant covers about one acre of ground, which lies along a spur line of the railway, giving them the very best shipping facilities. Pipe in all sizes from 2-inch up to 24-inch is manufactured. The plant gives employment to about twenty men, and has a daily capacity of 2,000 feet of 6-inch pipe, and 750 couplings.

Buffalo Steel Co., Tonawanda, New York.—A circular issued by this company deals with high carbon steel bars for reinforcing concrete.

The Ferro-Concrete Construction Co., Cincinnati, Ohio.—Bulletin F., 31, issued by this company, has to do with concrete for footings, piers, piling, foundations, bridge work, retaining walls, smoke stacks, etc. It contains several illustrations of work under construction.

THE "DALLETT" MOTOR-DRIVEN BOILER SHELL DRILL.

The Boiler Shell Drill illustrated is built by the Thomas H. Dallett Co., of Philadelphia, Pa. This machine is motor-driven throughout, and has been designed for the special purpose of taking advantage of high speed steel, and as shown in the accompanying cuts represents the latest development in machines of this character.

There are two end housings, on the front face of which, carried by brackets, are two 5-inch bars on which are mounted two independent motor-driven drill-heads balanced by the two counter weights, having a vertical range of 6 feet, and raised and lowered by means of screws actuated by a motor on the top rail of the machine, this motor being handled by a reversible regulator on the inside of the housing which does not appear in the cut.

An especially noteworthy feature of this machine is the central position of the spindles, not only between the bearings of the drill-head on the bars, but also between the bars, so that the pressure of the drill against the work has no tendency to set up torsional or sidewise strains in the drill-head or bearings, causing excessive friction of the drill in the hole, rapid deterioration of the drill and undue consumption of power, owing to the spindle being thrown out of alignment, as must be the case where a drill spindle is not central of its support.

The machine is entirely self-contained, all adjustments being effected by means of crank handles and hand-wheels, no wrenches whatever being required, and the operator has all the adjustments of the drill-head at his command from either side of said drill-head without moving from his position.

In the lowest position of the carriage, the centre of spindles are 21 ins. from the floor, and in its highest position 7 feet 6 inches. The distance between the housings is 14 feet, and the distance between the spindle centres when the drill-heads are in their outmost position is 12 feet.

The length of the standard machine over all is 17 feet 8 inches, the height 11 feet 6 inches, and the total weight 12,000 lbs.

The small cut shows one of the drill-heads with its individual motor, and illustrates the method of mounting the gear frame on trunnions. As this cut shows, each drill-head of 15 degrees to permit drilling rivet holes radially to the centre of the boiler which is set on rollers in front of the machine. The last movement is controlled by the hand-wheel which appears immediately beneath the gear reduction, Fig. 2. Fig. 1 shows one drill-head with the spindle in a horizontal position, and the other with it inclined upward.

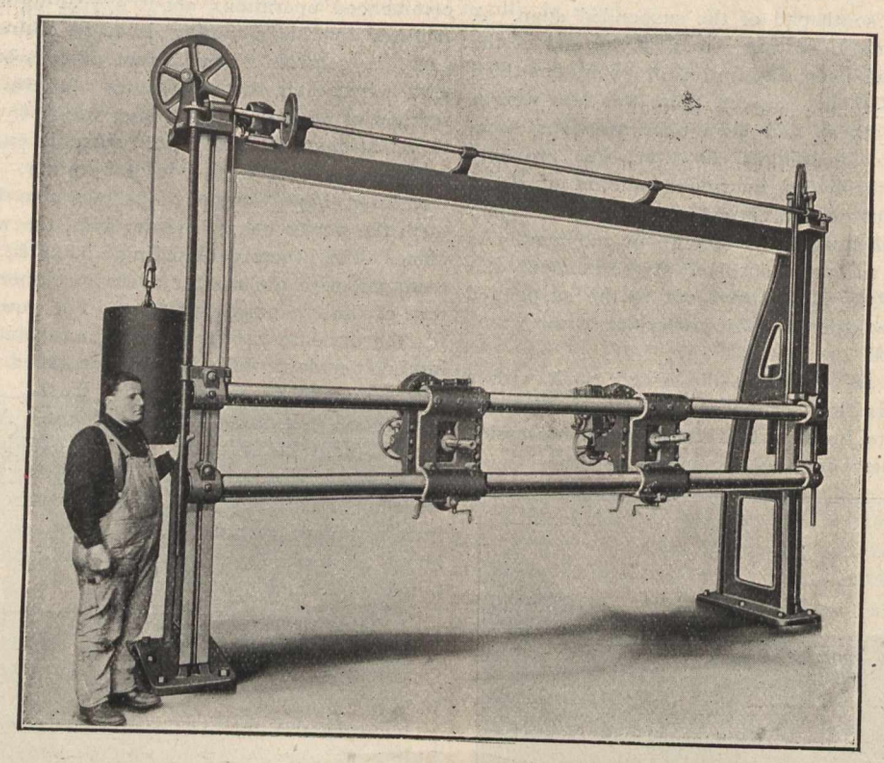


Fig. 1.

has a vertical adjustment in itself of 6 inches, operated by a crank handle at the bottom, and is moved along the bars by means of a pinion and rack on the under side of the lower bar. The motors shown on these drill heads are Northern two horse-power Variable Speed Motors, the regulating box and switch being mounted on the opposite side of the motor. There are no bevel gears used in the transmission from the motor-shaft to the spindle, making a very durable and efficient gear reduction. The spindle speeds range from 80 r.p.m to 160 r.p.m., and the whole mechanism of the drill-head is especially designed and built for the purpose of using high speed steel drills if desired. The spindle is 1-13-16 inches in diameter, and is bored for a No. 4 Morse Taper, has a traverse of 18 inches and a perpendicular range through an arc

The feeding mechanism consists of a feed-shaft, crank head, rocker pawl plate, pawl, ratchet wheel, feed nut and feed screw, the thrust of the latter being directly upon the back end of the spindle. The connecting rod between the crank and rocker plate is fitted with a spring which can be set free for any purpose of feed, so that it is impossible for this pressure to be exceeded, as the spring is compressed when the limit is reached, and the feed ceases to operate until the pressure is reduced, thus making an automatic relief. Change of feed is effected by shifting the thumb latch around the crank head, and a range of feeds from .005-inch per revolution of spindle to 1-16-inch can be obtained. The range of feeds covers the entire requirements of drilling in boiler work.

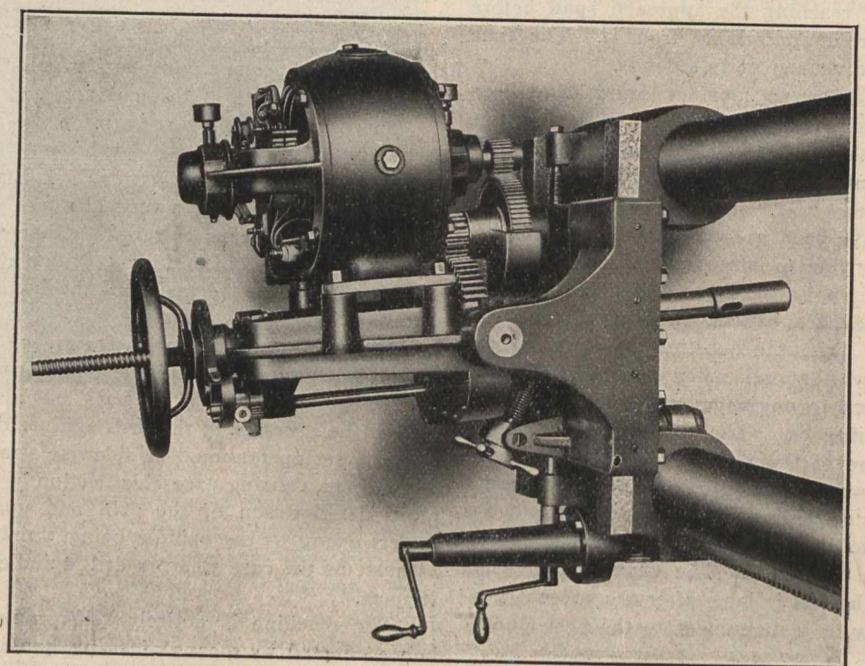


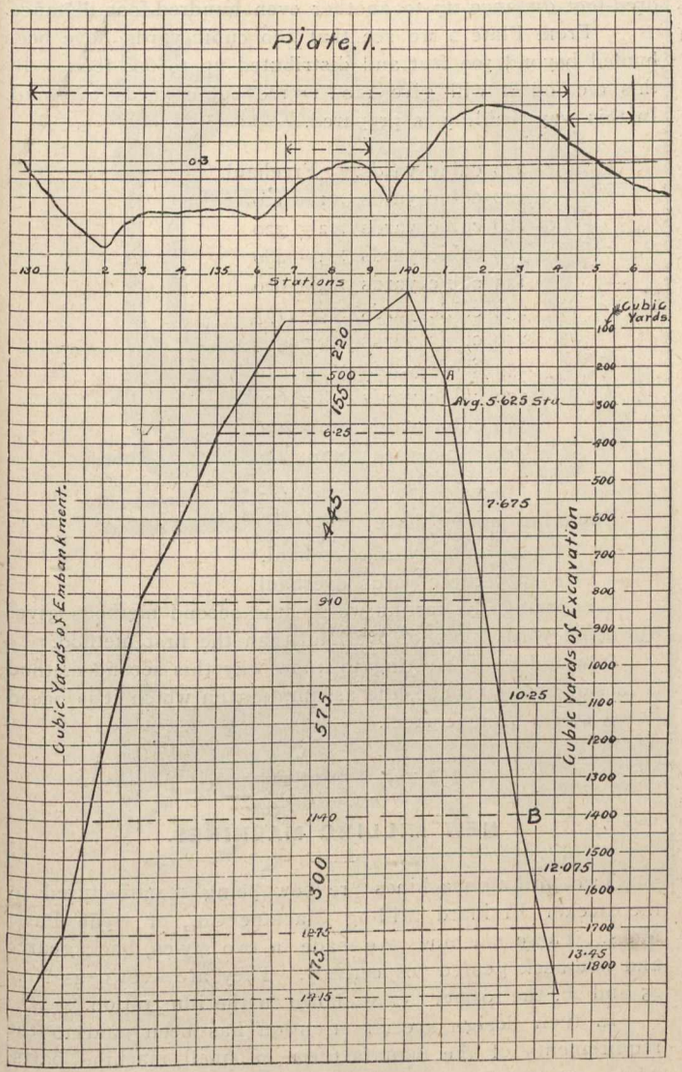
Fig. 2.

THE CALCULATION OF OVERHAUL.

E. A. J.

Specifications for railroad construction work usually stipulate that excavated material shall be hauled a certain number of feet, the schedule price per cubic yard covering this free haul, and all material hauled beyond the free haul limit to be paid for at a schedule price per cubic yard per 100 feet overhaul.

For years the standard method of calculation was the centre of gravity method, but of recent years graphic methods have come into favor. Unfortunately these graphic methods do not all bring the same results, and the purpose



of this paper is to describe two methods and compare the results, leaving to the reader the selection of the system best suited to his work.

That the description might be the more complete, I have selected an example, from actual work, to illustrate the methods. A rock cut, which was hauled through another cut, has been chosen as affording an example of the most general case. On the particular work where this cut occurred 500 feet was the free haul limit, the contractor receiving 2 cents per yard per 100 feet for all excavated material hauled beyond the free haul limit.

To prepare a diagram for the graphic calculation of overhaul take a role of standard profile paper, and near the top of the sheet plot the profile of the work, using preferably the scales usually adopted on railroad work, i. e.

Vert. 20 feet=1 in.

Hor. 400 feet=1 in.

With the aid of your progress profile indicate on the new profile the direction each cut or part of cut was hauled, also the limits of haul.

The selected cut, from sta. 140 to 144+25, was hauled so as to make the fill from sta. 149 to 130, with the exception of the small part made by cut 138+50.

Referring to the cross-section note book we find the number of cubic yards in excavation and embankment between each cross-section and from this we arrange columns one and two of Table 1, and in column three we place the summation of the cubic yards to each station, taking the grade point over which the cut was hauled as zero.

Table 1.

Station.	(1) Cubic Yd. of Emb.	(2) Cubic Yd. of Exc.	(3) Totals to each Sta.	(4· Fill Reduced.
130	...	...	3185	1873
...	321	...	....	....
131	...	...	2864	1700
...	770	...	....	....
132	...	...	2094	1232
701	...	...	....	....
133	...	...	1393	820
...	398	...	....	....
134	...	...	1047	615
...	346	...	....	....
135	...	...	649	372
...	398	...	....	....
136	...	...	353	208
...	227	...	....	....
+75	...	...	126	74
...	71	...	....	....
137	...	...	....	....
...	57	...	....	....
138	...	...	74	....
...	...	37	....	....
+50	...	...	37	....
...	...	...	....	....
139	...	...	126	74
...	63.0	...	....	....
+50	...	...	63	37
...	63.0	...	....	....
140	...	...	....	....
...	...	230	....	....
141	...	...	230	....
...	...	564	....	....
142	...	...	794	....
...	...	607	....	....
143	...	...	1401	....
...	...	435	....	....
144	...	...	1836	....
...	...	38	....	....
+25	...	...	1874	....
...	...	114	....	....
145	...	...	....	....
...	113	...	....	....
146	...	...	113	....
...	311	...	....	....
147	...	...	424	....

By studying column three we see that the quantity in the fill is almost 70 per cent. greater than the cut quantity. In actual construction we found that the cut from sta. 140 to 144+25 made the fill to sta. 130, so that in the breaking up and loose piling the rock has increased 70 per cent. in volume, not an unusual increase. Since all estimates were given according to cut quantities the fill quantities must be reduced proportionately until the total quantity in the fill equals the total cubic yards by the cross-section notes hauled to this fill from the cut. Thus ten-seventeenths of the fill quantities in Col. 3 give the quantities in Col. 4.

Just here it might be noticed that the quantities in cut 138+50, i.e., 74 cubic yards, made the fill from sta. 138 to sta. 136+75. This has been allowed for in the summation in Table 1, Col. 3.

Having selected suitable scales, say

Ver. 200 cubic yards=1 in.

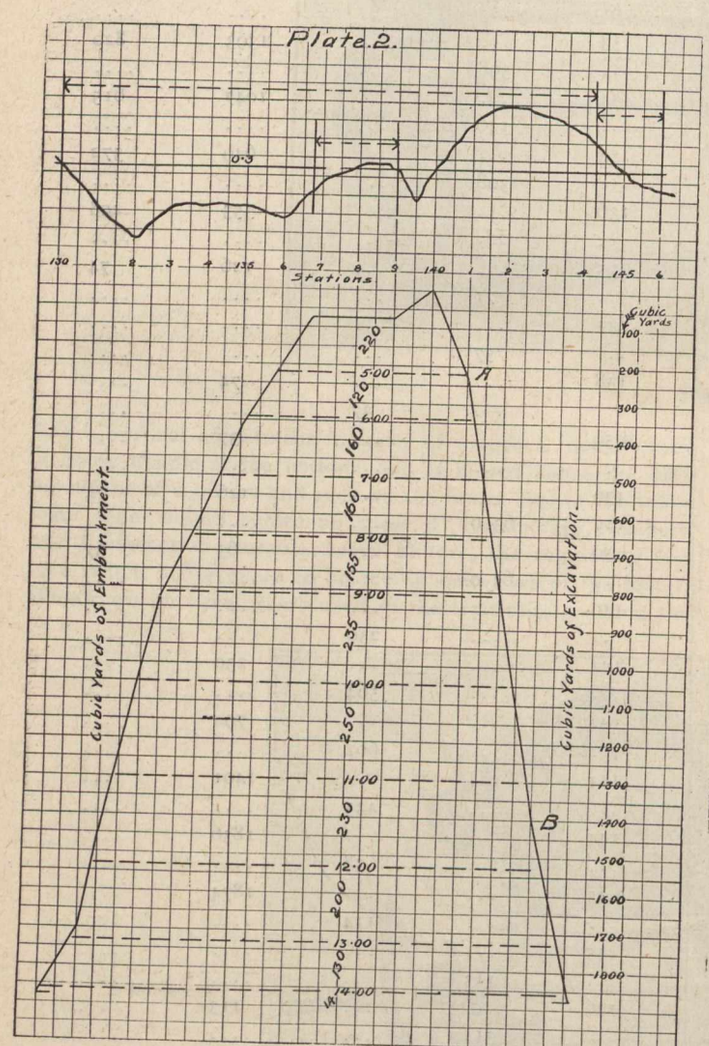
Hor. 400 feet=1 in.

we now proceed to plot two curves, one representing the quantities in the cut, and the other the quantities in the fill. From Table 1 we see that the change from cut to fill occurs at sta. 140. To prevent confusion select a point an inch below the plotted grade point and let this point represent the axis of the co-ordinates of the two curves to be plotted. On the vertical lines of the profile paper, which represent stations, plot points representing the summation of the cubic yards up to that station.

For example the point A represents sta. 141 and 230 cubic yards, the point B, sta. 143 and 1401 cubic yards, etc. Join the plotted points and we have curves as in Plate 1.

The quantities hauled and the distance hauled are now required.

To find the free haul, that is the haul less than 500 feet, scale and mark the points on the curve that are horizontally 500 feet apart. The scaled distance from this 500 foot line measured vertically to the axis represents the cubic yards of free haul.



To calculate the overhaul draw from the points of abrupt change in direction of curves horizontal line intersecting the curves. Scale the length of these lines in 100 foot stations, take the average of each successive pair and from this average subtract the freehaul distance, and you have the average haul of the yardage represented by the vertical distance between each pair of lines. The product of this average haul and the yards hauled will give the number of cubic yards, per station, of overhaul. In this way Table 2 is prepared.

Table 2.

220 cubic yards.	Free haul.	
155 cubic yards	×.625=	96.87
455 cubic yards	×2.67=1190.37	
575 cubic yards	×5.25=3018.75	
300 cubic yards	×7.07=2122.50	
175 cubic yards	×8.45=1478.75	
1870	Total	7907.25

Summing up we have from sta. 140 to 144+25.

220 cubic yards freehaul
7907 cubic yards overhaul
and 144+25 to 145
424 cubic yards freehaul.

Another method, and one in common use, assumes that material hauled over 700 feet has been hauled 800 feet and similarly for every hundred feet. Should this method be adopted the profile, Table 1, and the plotted curves will be the same as in the first method, but instead of drawing horizontal lines at each abrupt change in the direction of the curves horizontal lines are drawn where the lines of the curve are, 500, 600, 700, etc., feet apart as in Plate 2. The distance between each pair of horizontal lines represents the number of cubic yards hauled beyond a certain even hundred-foot distance up to another even hundred-foot distance.

From Plate 2 we see that 120 cubic yards have been hauled beyond 500 feet and distributed up to 600 feet. By this method it will give 120+1=120 cubic yards overhaul. In this way Table 3 is prepared.

220 cubic yards.	Freehaul.	
120 cubic yards	×1=	120
160 cubic yards	×2=	320
160 cubic yards	×3=	480
155 cubic yards	×4=	620
235 cubic yards	×5=1175	
250 cubic yards	×6=1500	
230 cubic yards	×7=1610	
200 cubic yards	×8=1600	
130 cubic yards	×9=1170	
14 cubic yards	×10=140	
1874 cu. yds.	Total,	8735

Summing up we have

220 cubic yards freehaul,
8735 cubic yards overhaul.

Comparing the results we see the second methods gives 838 cubic yards more of overhaul than the first method.

It would be interesting to know why this second method is in such common use, the assumption on which it is based being so far from correct.

NEW MILLING MACHINES.

Two milling machines are now being manufactured by the Becker Brainard Milling Machine Co., of Hyde Park, Mass. These machines are made in two styles, back geared and not back geared respectively. They are known as Nos. 25 and 26, the former being shown in the illustration.

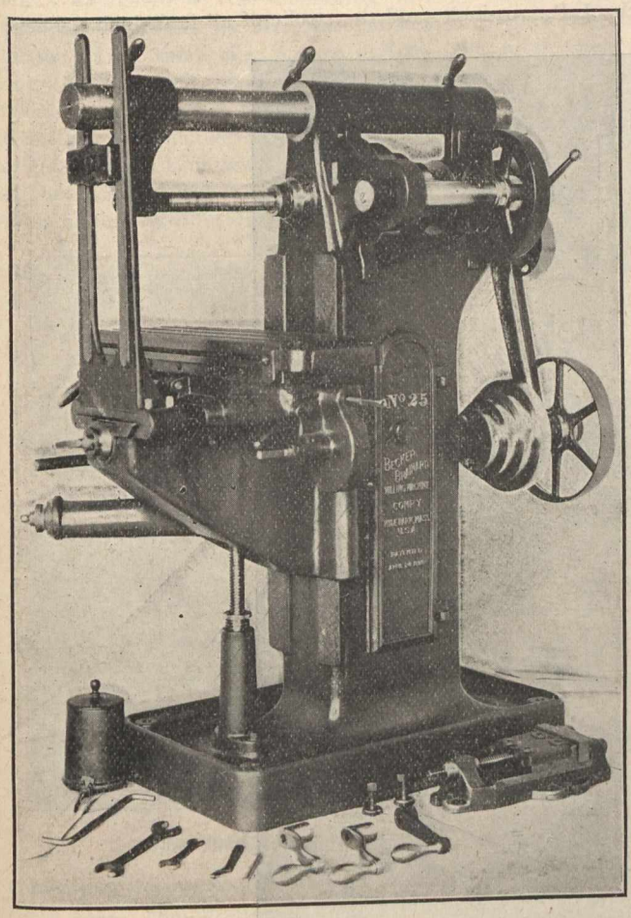
In their design special attention has been paid to the requirements of the manufacturer of small machine parts, which are produced in large quantities such as found in small arms, typewriters, sewing machines, and electrical works. In bringing out the new model especial attention has been given to the feed works that they may be able to withstand the full power of the driving belt, and at the same time give good service in the rough usage to which these machines are subjected. This new feed is driven by belts which get their motion from the spindle of the machine by means of a train of gears, so arranged that the velocity of the belt is sufficient to drive all feeds that the main belt will stand. The changes of the feed are obtained by four step cones and by interchanging the feed driving pulleys on the back of the machine, giving in combination eight changes from .007 to .100.

The ranges of these machines are: Longitudinal feed, 34 inches; cross feed, 8 inches: vertical adjustment, 18 inches; net weight, 1,650 lbs.

The table is operated by worm and hobbed rack, the worm being driven by means of a worm gear of large size and worm of coarse pitch and of correspondingly high efficiency. The arrangement for disengaging the feed is by

a new and novel worm mechanism by which the worm is thrown out of mesh with the gear, and leaves in a path at right angles with the axis of the same, overcoming the objection of the old style gravity drop worm of clinging to the gear by friction alone. It also equalizes the wear on the worm gear teeth. The worm is also engaged and thrown out of mesh by the same lever, making in all a neat, convenient and positive method of automatically disengaging the feed and stopping the travel of the table at a predetermined point. The table is also supplied with a hand quick return of 4 to 1 ratio, allowing it to be returned to the original position in the least possible time.

The knee of the new model has been lengthened sufficiently so that a harness may be used for the arbor, and still have a cross range for the table equal to that of the old style



machines. This harness is especially worthy of notice and makes for convenience as well as rapidity. It consists of a brace which is gibbed to the knee slide; a clamp that is fastened to the arbor support yoke in a manner that allows it to be swivelled around its center, allowing the brace to be removed without removing any bolts. This clamp is made fast to the brace by friction, which gives a more rigid hold than the old style bolt washer and slot arrangement, at the same time allowing of a much stiffer brace. The convenience of this device will be at once appreciated by the operator. The arm, which is a solid steel bar, is adjustable lengthwise.

These machines are equipped with a rigid box knee and with a telescopic elevating screw, allowing the machine to be set in any position without regard to beams on floor construction, as the screw does not project below the floor line.

The base of these new model machines is extra heavy, and has been designed on the same lines as the other, all built by the same manufacturers. The spindle cone and back gears are of the standard Becker Brainard design, the spindle bearing being cylindrical in form, the wear being taken up by concentric compensating bronze boxes. The appearance of the machine has in no way been neglected since new patterns were made throughout. Great care was given to the symmetrical appearance of the machines as a whole, all corners being well rounded.

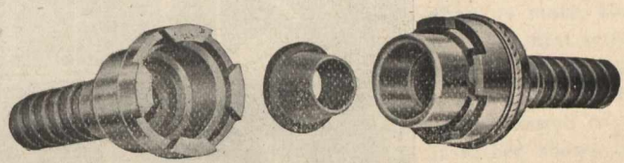
AUTOMATIC HOSE COUPLINGS.

Of late years compressed air has come into more or less general use; in fact to-day it is almost impossible to find an engineering establishment where it is not used. This has resulted in keen competition amongst the manufacturers of fittings used in connection with pneumatic tools, and among other pieces that have received particular attention is the hose coupling.

One of the latest and best couplings to be put on the market is that manufactured by the Thomas H. Dallett Company, of Philadelphia, Pa. This coupling stands in the front rank. It is a marked improvement over many of the hose couplings heretofore manufactured. The illustration herewith shows the two halves of the coupling together with the gasket used.

The gasket is of a rubber composition, not affected by oil or gasoline, and is held in the female half of the coupling by the flange around the larger end fitting into a recess. It is impossible for this gasket to fall out or be lost when the coupling is disconnected, and when necessary, a new gasket can be inserted in a few seconds.

When the coupling is connected, the tapering end of the gasket enters into the conical opening in the male part and is a loose fit therein. When pressure comes on the coupling this tapered end of the gasket is expanded against the wall of said conical opening, making a perfect joint, which the greatest



Automatic Hose Couplings.

pressure will only make the tighter, and as soon as the pressure is relieved, the gasket is again loose, so that no matter how long a coupling may remain connected, it will not adhere to the metal and be torn and ruined in the coupling being taken apart.

As will be noted, the male part of the coupling is provided with four locking-lugs, equally spaced around its circumference, and when the male and female parts are snapped together, these lugs insure their being held squarely, which obviates any tendency to leak.

To connect the coupling, it is only necessary to press the parts together, give one-eighth of a turn and the locking-ring will spring into place. It is then a physical impossibility for it to be pulled apart or accidentally disconnected. When the connection is to be broken, press back the locking-ring and give the coupling one-eighth turn.

The entire coupling is made of a very hard bronze composition, has no small parts to give trouble, and no projecting pieces to catch when the hose is trailed along the ground. The locking-ring is provided with a milled ridge around its circumference which affords a good grip for pressing it back when disconnecting the coupling and so stiffens and strengthens it that it requires extraordinary abuse to spring or bend it so as to impair the working of the coupling.

THE PUMPING PLANT OF THE OMAHA WATER COMPANY.

By Willis Collins.

From the standpoint of high economy continuously maintained throughout a long period of time, the central station of the Omaha water works system, equipped with Allis-Chalmers pumping engines, has a record of more than ordinary interest.

The construction of this system was begun in 1880, when the population of the city was only 30,000, and completed in 1883. When completed the system had 28 miles of water mains and 250 fire hydrants. The Missouri River was the source of supply. The water was first pumped up about 30

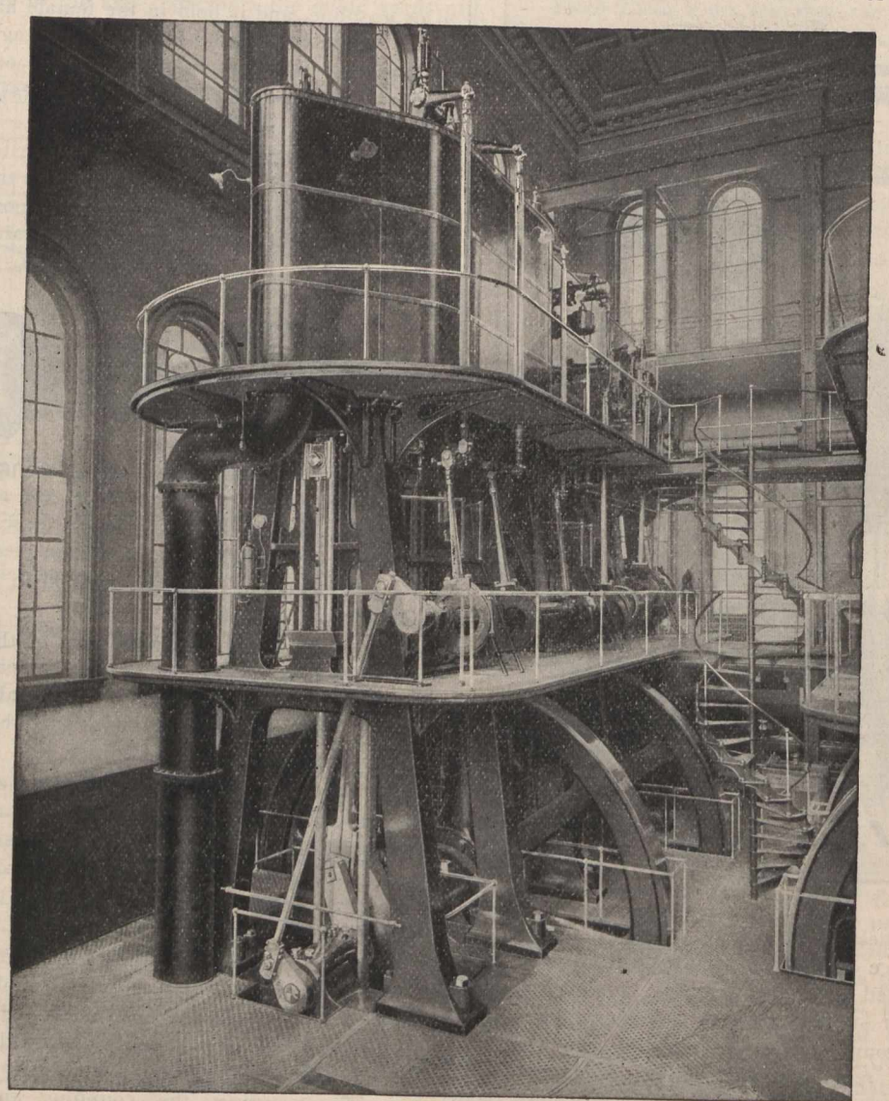
feet to four large basins on the river side, where sedimentation took place, considerably clarifying the water. The clarified water flowed to the suction of the high-lift pumps, which discharged to a 10,000,000 gallon reservoir on Walnut Hill. Water was supplied to the City of Omaha, South Omaha, and the suburbs of Dundee, Florence, and East Omaha. In 1886 the average daily consumption was about 6,000,000 gallons.

In 1887 a new central pumping station was built at Florence, Neb., which is located several miles up stream on the Missouri River beyond all danger of sewage contamination to the water. The plant is surrounded by 107 acres of parked ground, and is called Minelusa, the Indian name for pure water. The mechanical equipment of this plant is particularly fine. Although some of the machinery has been in operation for nearly twenty years, the record for economy and reliability is most creditable, and comparable with pumping plants built ten or fifteen years later. The low service and high service pumps are installed in the same station, and the sedimentation basins, has a wonderful clarifying effect and practically removes all of the red silt from the river water by the time it reaches the last basin. The clear water flows to the high-lift pumps under a slight head.

In 1898 the increase in water consumption demanded additional pumping capacity, and an 18,000,000 gallon Allis-Chalmers vertical compound pumping engine was installed for low service duty, and a little later, in 1902, a 20,000,000 gallon vertical triple Allis-Chalmers pumping engine was installed to give increased capacity for the high-service system, making, in all, five pumping engines with an aggregate capacity of 80,000,000 gallons per 24 hours.

All of these pumping engines have records for reliability, there has never been a break requiring a shut down for repairs.

The first vertical, triple-expansion pumping engine has the following cylinder diameters: H.P., 40-inch; I.P., 70-inch; L.P., 104-inch; and the stroke of all is 60-inch. These



Allis-Chalmers Vertical Triple-Expansion Pumping Engine.

supplied with steam from a common boiler plant. The first installation consisted of two 12,000,000 gallon vertical compound, crank-and-fly-wheel pumping engines of the Allis-Chalmers type to work under a head of 70 feet for the low service, and one 18,000,000 gallon vertical, triple-expansion pumping engine of the Allis-Chalmers type to work under a head of 310 feet for high service, discharging to reservoir and distribution system. The low service pumps deliver the water to a series of sedimentation basins on the bank above the river; these basins being arranged with a series of cascades between adjacent basins, with water levels carried so as to give a drop of 2 or 3 feet over each series of cascades. The cascades have sills perfectly level, and long enough to carry the maximum amount of water in a very thin sheet. Air is admitted freely behind the falling water. This complete aeration of the water, alternated with complete rest in

cylinder sizes were very much larger than anything ever designed for pumping engine work at that time. The total weight of the machine was about 750 tons. The introduction of this unit reduced the consumption of fuel 50 per cent., and for some years was claimed to be the most economical pumping engine unit in service, requiring but 1½ pounds of coal per horse-power per hour.

The second vertical, triple-expansion pumping engine has steam cylinders of the same diameters as corresponding cylinders on the first engine, but the stroke is increased to 66-inch. Each pumping engine makes twenty revolutions per minute, and the second machine has 10 per cent. greater capacity on account of the longer stroke. The second machine is of the "self-contained" type, with the steam engine supported by the pump chambers.

There are now 230 miles of water mains, and about 15,000 service connections to the Omaha water system.

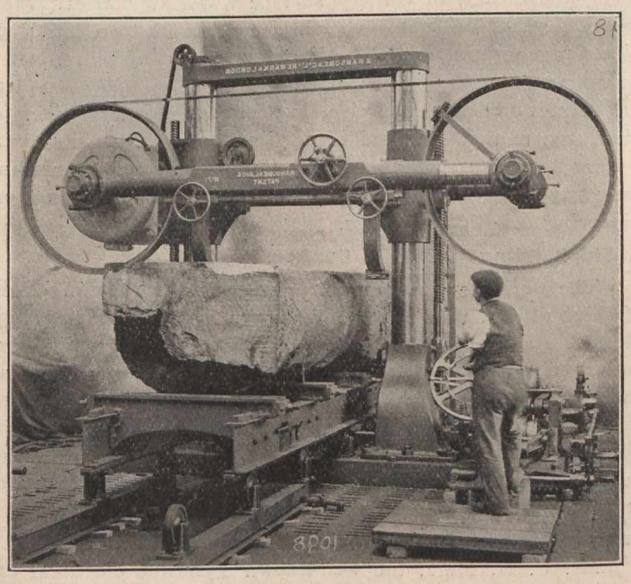
ENGINEERING NEWS FROM GREAT BRITAIN.

(From our Own Correspondent.)

London, August 20th, 1907.

The Wireless Telegraph Convention.

Some indication has leaked out regarding the report of the House of Commons Committee which dealt with the question of whether or no Great Britain should ratify the Radio-telegraphic Convention which was signed in Berlin in the autumn of 1906. It will be remembered that this laid down the principle of free intercommunication between all systems, subject to the right of an signatory power exempting specified stations. A set of regulations were also drawn up under which all stations would have to work. The very strong views expressed by the managing director of the Marconi Company, and also by Mr. Marconi himself, before the committee, made their task a very difficult, not to say delicate one, and it appears that only by a majority of one have they decided to recommend Parliament to ratify the convention. Even so, a protective clause has been put in for the benefit of the Marconi Company, for it is stipulated that in the event of the economy demonstrating that the financial position has been materially effected by the operation of the terms of the



Electrically Driven Log Band Saw.

convention, compensation shall be paid on the basis of a three years' computation of the profits derived from British stations.

Electric Power in London.

Since my previous notes on this subject, the electric power supply problem has undergone a complete change, and the way seems to have been cleared once more for private promoters. The bill of the London County Council has been under consideration by a committee of the House of Commons for a week, and the engineering and financial proposals had been discussed by the officials of the council at great length, when, to everybody's surprise, without either asking for further details or hearing the views of the opponents, the chairman of the committee announced that the committee had decided to reject the bill. A draft form of lease was put before the committee, from which it was seen that it was the intention of the County Council to lease the powers of the bill, if they had been obtained, in such a way that a private company would have worked the undertaking upon engineering lines evolved by the Council, and generally under the supervision of the Council. It was an open secret that the promoters of the Administrative County of London and District Electric Power Company were in negotiations with the Council for a lease of the powers of the bill—they themselves all but secured a similar measure in 1905, but the passage of the bill was obstructed in the House by political opponents. The present bill, however, was undoubtedly rejected owing to the political feelings of the committee which considered it, for whatever the policy of the Council, it does not appeal to one as quite the thing to place upon the committee a member who had, already in the House, publicly expressed himself as antagonistic to the bill. In this way is London deprived of the advantages of a cheap power supply, which on all sides is admitted as urgent. Next year no doubt companies will submit proposals, and in the present temper of a strong Progressive House of Commons it is quite conceivable that they will all be rejected. In these circumstances it will depend upon whether the leaders of the party can prevail upon the rank and file to allow proposals by companies to go forward. It will thus be seen what a purely political character has been given to an engineering problem of great interest.

England's First Motor Racing Track.

The great Brooklands motor racing track, of which no doubt some notice has already reached Canada, is situated at Weybridge, a few miles out of London. It has a circuit of 3¼ miles, and is 100 feet wide. There is said to be seating accommodation for 30,000 people, and standing room for half a million. It has cost $750,000 to construct. As an engineering feat, there is nothing over here to compare with it—it is said there is nothing comparable in the world—but already it has been demonstrated that there is much about the modern motor car yet to be understood. The first serious use to be made of the track was an attempt to ride 60 miles an hour for 24 hours—the fact that the rider succeeded is immaterial here, but seeing that during the course of the ride the track was torn up in places, it rather shows how little experience there is of this sort of thing, especially when one remembers that the track is concrete 5 inches thick

Automatic Railway Wagon Couplings.

A committee was appointed some time ago to enquire into railway safety appliances in general, but it has not yet considered the question of automatic couplers. I learn, however, that the chief inspecting officer of railways has recently made an independent investigation into the matter, and has advised that there is good reason to doubt whether the adoption of such appliances would tend appreciably to reduce accidents. The committee above mentioned has been considering the question of "either side" brakes, and I believe the Board of Trade will shortly propose a rule on that subject.

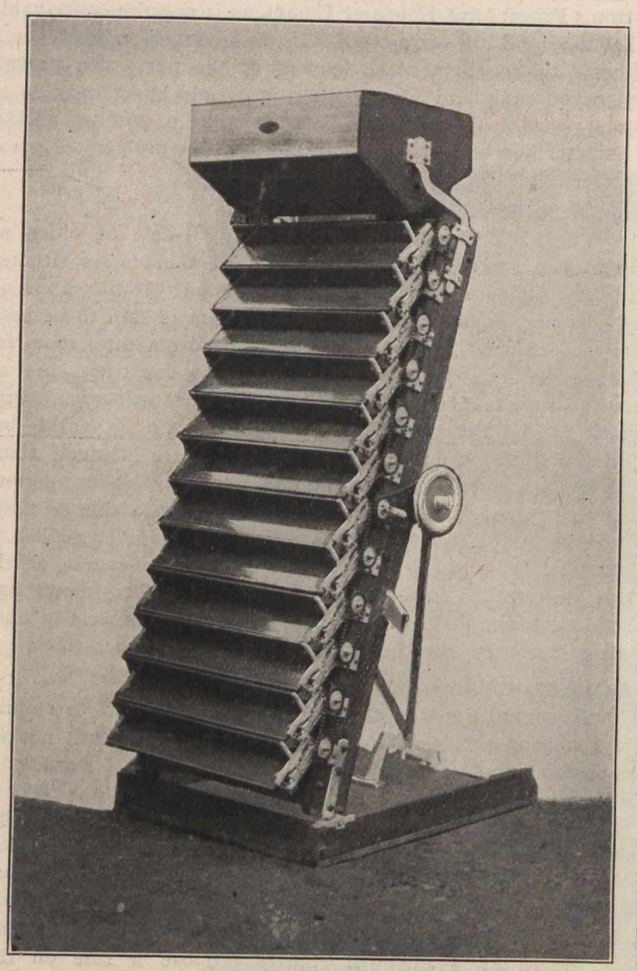
Ferro-Concrete Construction.

In view of the increasing use of ferro-concrete construction for many purposes, a statement by the president of the Local Government Board is of considerable interest. A member of the House of Commons asked for a reason for the Local Government Board requiring loans for such works to be paid off in shorter periods than for ordinary methods of construction, especially in view of the fact that it had been proved both on the Continent and in the United States after many years experience to be durable and fire resisting, and that it was about to be used in the construction of the new General Post Office. From the reply, it appears that the Local Government Board is advised that it is doubtful whether ferro-concrete is a suitable material for permanent constructional works under all conditions, and that there is need for caution in dealing with it; in fact examples of the failure of works so constructed have come under the notice of the Board. The present feeling of the Local Government Board, therefore, is that its use has not always been successful, and the period of short loans now in vogue will be continued.

Railway Rolling Stock Specification.

The Engineering Standards Committee will shortly issue a new specification for railway rolling stock. There have been a number of revisions, of which the following are the principal: In the specification for steel castings the number

of tensile and bend tests required for wagon wheel centres has been reduced, as it was considered that the quantity asked for under the existing specification was somewhat in excess of that usually obtaining in general practice. For locomotive wheel centres cast with heavy balance weights it has been made permissible to reduce the height of the fall in the drop test. An alteration has been made in the specification for copper and brass tubes for locomotive boilers, a drifting test having been added to the clause dealing with the bulging test. The principal alterations in connection with steel plates are in connection with the new standard 4 diameter test piece for bars of over one inch diameter This shorter test piece has been introduced to reduce the



Seed Dresser.

amount of material required for testing, and the amount of turning down when such is necessary. A temper bend test of the rivet steel has been added in the case of rivets.

Royal Agricultural Society's Show, Lincoln.

Having tried the experiment for three years of making London its permanent home, with disastrous financial results, viz., in 1903, 1904, and 1905, a reversion of the original policy of visiting a different town each year was made in 1906. This year Lincoln was selected, a town previously visited fifty-three years ago. As usual the main interest lay in the agricultural implements, of which there were many exhibits. The show ground covered 125 acres. There were also the competitions, which this year were confined to swath-turners and side delivery hay rakes. In the former class both prizes went to Messrs. Blackstone & Co., of Stanford. An interesting exhibit was a log band saw, electrically driven, on the stand of Messrs. Ransome & Co., of Newark. The motor armature is built on the axle of one of the saw pulley shafts, thus giving a direct drive which is becoming common with machine tools. It is stated that the energy necessary for dealing with 100 superficial feet is one kilowatt hour. The machine is capable of handling logs three feet in diameter. The machine which secured the society's medal under the " new implement " section was a seed dresser by Mr. F. M. Dossor, of Doncaster, which has been designed for the purpose of cleaning small seed, such as clover, and extracting all foreign matter. The machine can be hand or power driven. The seeds pass through a number of overlapping velvet belts driven by chains and chain wheels. The machine shown at Lincoln was capable of dealing with from 15 cwt. to 20 cwt. per day of nine hours. The machine is 7 feet 9 inches high and occupies a floor space of four feet. There were the usual large number of traction engines and windmills on view, and a number of steam wagons. The exhibits also pointed to the suppression of hand milking by mechanical means, several pieces of apparatus of this class being exhibited.

The Engineering Conference.

The biennial engineering conference held in London under the auspices of the Institution of Civil Engineers took place towards the end of June, and although it is obviously impossible to give anything like an account of the proceedings in a short note, a few particulars may be interesting. The president was Sir Alex. B. W. Kennedy, F.R.S., and among the various matters discussed in the seven sections into which the conference was divided were the following: Light Railway Policy; relative advantages of Electric and Hydraulic Appliances for dock equipments; audible signalling on railways; dredging rock in the Suez Canal; machine tool design as affected by high speed cutting tools; arrangement and design of colliery surface works; electrical transmission gears on motor vehicles; upkeep charges on large electric generating sets. Altogether the conference was a pronounced success, although, of course, certain papers did not attract exceptional notice, but from the general point of view, the method adopted of reading only short notes with a view to encouraging long discussions (instead of reading long papers) is one which can be recommended to most engineering debating societies.

A Shipbuilding " Entente Cordiale."

The working arrangement between the two leading firms of shipbuilders, viz., Messrs. J. Brown & Co. (Glasgow) and Messrs. Harland & Wolff (Belfast) has provided a mild sensation, despite the fact that rumours were naturally flying about before official confirmation was forthcoming. It would appear that there has been an exchange of shares with the object of, in future, distributing the work of the two firms in a more economical manner between the various workshops at Belfast, Glasgow, and Southampton.

British Engineer for Victorian Railways.

Mr. C. H. Merz, the well-known Tyneside electrical engineer, who was responsible for the first steam railway in Great Britain, converted to electric traction, has been selected by the Premier of Victoria (Australia) to visit that colony and advise in connection with the conversion to electric traction of the steam railways there. Mr. Merz, it will be remembered, was the engineer who in 1905 gave such prominence to the electric power problem in London, and who, though himself unsuccessful through political obstruction, has had the doubtful satisfaction of seeing subsequent schemes based upon his own.

Imperial College of Science.

The Board of Governors of the new Imperial College of Science and Technology at South Kensington, London, is now complete, and the draft charter for the establishment of the college has been submitted to His Majesty the King for his approval.

Telephone surveys of the city of Winnipeg have been made by the Government telephone officials, and subways have been laid out. It is expected that the actual work will begin before the end of the month. The contracts for subways include from 70,000 to 80,000 trench feet comprising 500,000 duct feet. This work is all being laid out similarly to Winnipeg.

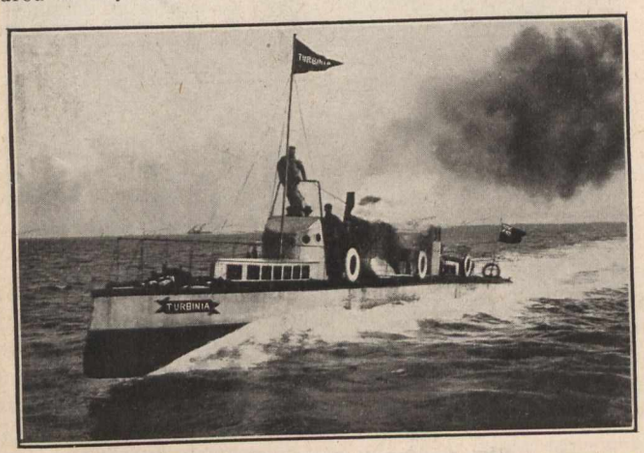
The town of Hebertville, is considering the installation of a system of waterworks, in the immediate future, and Mr. V. H. Dupont, C.E., of Montreal, has submitted, by request, a plan for a system to cost in the vicinity of $36,000. A by-law will shortly be submitted in this connection.

THE PARSONS STEAM TURBINE IN MARINE SERVICE

By J. Colder.

The diminutive experimental turbine launch "Turbinia," shown in the accompanying illustration, was used in rather a novel way by the inventor to attract the attention of the British Admiralty to the particular type of propelling machinery installed in that vessel. He attended, uninvited, "Queen Victoria's Diamond Jubilee Naval Review" at Spithead in 1897, and deliberately trespassed in and out between the lines of warships, thereby challenging the patrols, who were unable to come near, much less overtake him.

At that time the steam turbine had not been manufactured in any size above 800 horse-power, and that was for



"Turbinia" making 33 knots at Spithead Naval Review.

driving generators and electric light and power stations. It was, therefore, not very widely known, and consequently received with considerable distrust. Nevertheless, in about eight years after the inventor's daring escapade above mentioned, he has supplanted the reciprocating engine and driven it out entirely from the largest navy in the world, except in the case of submarine, where it is not suitable.

It is safe to say that only those aboard the "Turbinia" that day could have foreseen that within the next decade the turbine would be so far developed that the British Navy would cease to order anything else. This is the case, however, as is proved on reference to the Navy estimate which ceased, with the 1905 programme, to include orders for reciprocating engines. All the new vessels from that date onward are being equipped with Parsons turbines. At the end of March 1907 there were fourteen warships completed, aggregating 107,000 horse-power, and forty-nine building, aggregating nearly four times that amount.

For commercial purposes the progress and development has been quite as great. It was first applied in this direction in 1901 by the building of a pleasure steamer of about 7,000 horse-power at 21 knots. To-day, only seven years after, there are thirty-four merchant vessels and seven yachts completed; sixteen merchant vessels building, and two yachts. The total of all classes of ships built and building is, therefore, 122; and the total equivalent I.H.P. is one million three hundred thousand. Included in this are two of the largest marine installations ever contemplated, three of the fastest cruisers ever built, several high speed channel steamers, and one torpedo boat destroyer which is guaranteed to give the terrific speed of 36 knots, nearly 41½ statute miles per hour.

Naturally the progress of the marine turbine has been greater in Britain than in other countries; but Europe and the United States have not neglected the subject, for at the present time Germany has a turbine cruiser and destroyer. France recently placed an order with the Parsons Company for engines for six battleships. Italy has laid down a cruiser and a dispatch boat. Japan has placed an order for a dispatch boat, and the United States Navy Department has two cruisers building. In addition to this the United States has seven turbine steamers completed and on order.

The whole of the foregoing, with the exception of one single United States cruiser, refers to turbines of the one type, viz., Parsons. There are, of course, dozens of other types; but not one of them may yet be said to have passed out of the experimental state as regards marine propulsion. There are only two turbine vessels of any other type operating commercially at the present time.

The original "Turbinia" was first fitted with one radial flow turbine and one shaft, but propeller difficulties made it impossible to attain much more than 18 knots. This single turbine was consequently taken out and the power divided between three separate turbines, each driving 3 propellers, and with this equipment the phenomenal speed of 34½ knots (nearly 40 miles) was obtained. From this was devised the present standard arrangement of having three turbines, one high pressure and two low pressure, each driving one propeller.

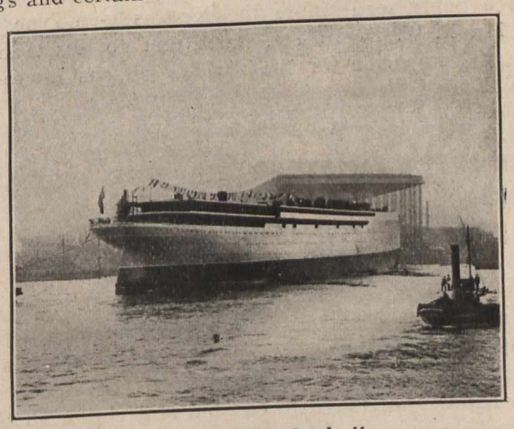
The Parsons turbine is substantially of the same construction as the land turbine being built by Allis-Chalmers Company, Milwaukee, under the patent rights of the Hon. Charles A. Parsons.

The Cunarder "Muretania," now building at Wallsend-on-Tyne, will be fitted with the largest turbines yet built. Particulars of this steamer are as follows:—

Cunard Express Turbine Steamer "Muretania."

Length, 790 feet; breadth, 88 feet; depth (moulded) 60 feet; gross tonnage, 32,500 tons; displacement tonnage, 45,000; low draft, 37½ feet; height of funnels, 155 feet; diameter of funnels, 24 feet; height of masts, 216 feet; speed, 25 knots per hour; accommodation, 500 first class, 500 second class, 1,300 third class; crew, 800.

The turbines in this, what might be termed floating city, will have a capacity of about 70,000 horse-power each. The largest marine turbines heretofore built had a capacity of 10,000 horse-power. These were for the "Virginia" and "Victorian." From this some idea is afforded of the difficulties which had to be overcome in the design of the new Cunarders. With the view to arriving at the most suitable form of model, tank experiments were made by the Admiralty officials of Haslar on models of varying dimensions and forms. These experiments extended over some months, and by this means the dimensions and form of model generally were determined; but Messrs. Swan, Hunter, & Wigham Richardson (Limited) decided to investigate further by experiments on a larger scale to arrive at the best form of shell bossings and certain details associated with the run; also the



The "Mauretania."

most suitable diameter, pitch, and surface of propellers and their best position to ensure the highest efficiency and general manoeuvring power. To carry out these experiments in a reliable manner the firm had a large working model, 47·5 feet long by 5·33 feet beam, made. This model was constructed with the greatest care to the lines which were designed for the ship, and was self-propelled by four electric motors, driving four shafts and propellers. Instruments were fitted to each motor and shaft to indicate (1) the power given off by the motors; (2) the power transmitted by the shafts, determined by the torsion meters; and (3) thrust of propeller, revolutions by counter and tachometer; also current meters were provided to arrive at the speed of the wake. The experiments were conducted in the Northumberland

Dock of the River Tyne Improvement Commissioners, where there is a clear course of about three-quarters of a mile, a clear width of about 100 feet and a depth varying from 20 feet to 30 feet. The experiments commenced early in April, 1904, and extended over a considerable period. They were conducted under the charge of one of Messrs. Swan, Hunter, & Wigham Richardson's staff, with an electrician to attend to the motors and gear and another man to steer. The following were investigated, and the results obtained incorporated in the design of the ship and propellers, and communicated to the Cunard Steamship Company as the experiments progressed:—(1) Turning and manoeuvring trials; (2) wind resistance; (3) wake when propellers were running; (4) skin friction; (5) wave formation; (6) limits of error due to wind and effect of fouling ship's bottom; (7) apparent slip; (8) rudder efficiency; (9) time and speed in turning; (10) stopping and reversing; (11) turning by screws; (12) tactical manoeuvres as an armed cruiser; (13) most efficient position of propellers; (14) effect on speed of "choppy" seas; (15) effect of cutting away deadwood; and, lastly, the effect on propelling efficiency of the use of boss cones and sleeves of shell bossing.

During the time these investigations were being made, the foundation for the vessel was being built. An area of 650 feet long by 35 feet wide was driven with piles, five to a row, the rows being four feet apart. These piles were of pitch pine about 35 feet long, and were driven by a two ton hammer. On these piles was built a solid deck of six inch planking. This deck reached the ground level, and upon it the keel blocks were laid. On account of the large size of the "Muretania," and the severe stresses which will come on the upper works in tension, silicon steel has been adopted for the shell doublings and doublings on two of the decks. To save weight, high tensile steel was adopted for the plating of the various watertight bulkheads. The silicon steel had an ultimate tensile strength at least 20 per cent. greater than the ordinary quality of mild steel, and, therefore, where silicon steel was employed, a reduction was made of about 10 per cent. from the scantlings fixed for mild steel. Not only was a considerable saving in weight effected by this, but better riveting was made possible owing to the finer plates and smaller rivets used. The main frames and beams placed end to end would extend over 30 miles, whilst the largest shell plate weighed from 4 to 5 tons, and the total number of plates which have been used has exceeded 26,000.

In a paper read before the Newcastle-on-Tyne Association, Mr. E. W. De Russet, stated that no less than 54,000 drawings were made for the various persons interested in the building of the vessel.

MODERN AMATEUR MACHINE SHOPS.

By W. L. McLaren.

II.

In a Northern city there lives a young man aged twenty-one, who when he was ten years old used one of the springs of the baby carriage, which he himself had ridden in, to make a hand-power magneto capable of giving a shock that would make a strong man jump. At the present day he has an outfit of small motors, generators, gas and steam engines, guns and pistols large enough to stock a curiosity shop; most of them made by himself.

The shop contains a small foot power bench lathe, fitted for screw cutting and indexed for milling with a small home-made milling attachment, which for simplicity and general effectiveness might give pointers to some of the people in that line of manufacture. The shop is situated in the cellar of his fathers residence and besides the lathe contains a bench and vice and small Salamander boiler which furnishes steam to an engine of 1½-in. bore by 2-in. stroke, which alternately drives either a small electric generator and emery wheel (the emery wheel is upon occasion replaced by a saw when there is any wood-work to be done). Fig. 1 shows the boiler and engine, the latter being belted to the dynamo. The engine is of the Crocker Wheeler type, rated at 1-6 horse-power, and operates a 250 volt generator at 1,700 revolutions per minute, the engine running at 550 revolutions per minute. The boiler carries a pressure of 110 pounds.

Fig. 2 shows a 25 volt 1-16 horse-power Edison type generator with self-aligning bearings, built five years ago, this machine has to run from 3,000 to 4,000 r.p.m. to give the above stated horse-power.

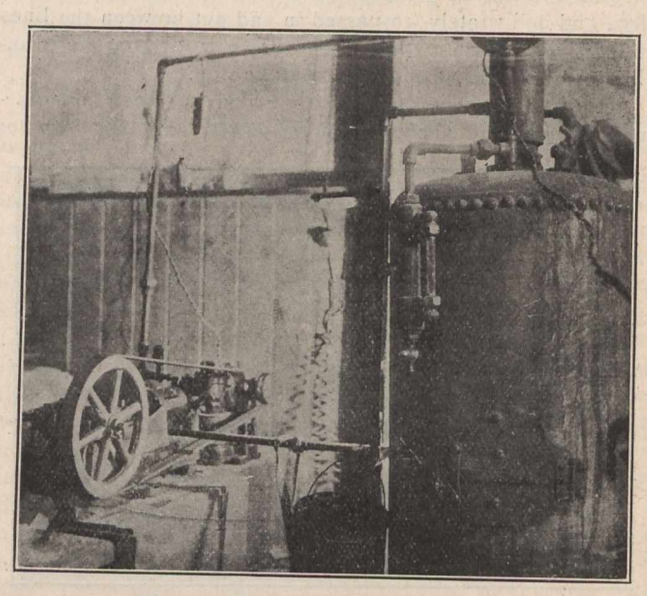


Fig. 1.—Small Engine and Boiler.

Fig. 3 shows a bullet-sizer and lubricator designed and built very recently, as far as I know there is no such useful article on the market. It is a very simple affair, the bullet being placed in position is forced down by the lever to a mark or stop, then the handle of the grease cup is given a sharp twist which forces the lubricant into the grooves, the lever is then made to finish its stroke, dropping the bullet out ready for the shell. Different sets of dies are, of course, used for different calibres.

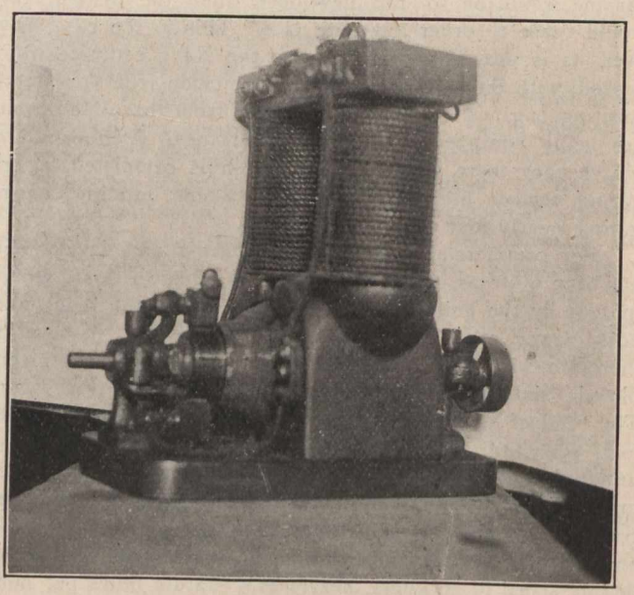


Fig. 2.—1/16 Horse-power Generator.

The most recent product of the little shop, is nothing less than a 22 calibre automatic pistol, the magazine of which holds ten cartridges, every part of the arm was made and machined on the premises, even to the rifling of the barrel, which is four inches long, having five lands, one turn in 14 inches. The whole automatic mechanism is contained in the breach bolt, there being two springs, one for the striker and one for returning the bolt after the discharged shell is thrown out. The barrel being practically solid with the frame (it is screwed in tight, 18 threads to the

inch) gives a high degree of accuracy, which is more than can be said of the product of at least one of our leading automatic pistol manufacturers.

Besides the articles shown in the illustrations, Mr. Sydney Graham, owner of this unique little shop, has made a 1-12 horse-power, 30 volt generator, running at 4,550 R.P.M.; a small turbine fitted with a worm gear drive, the

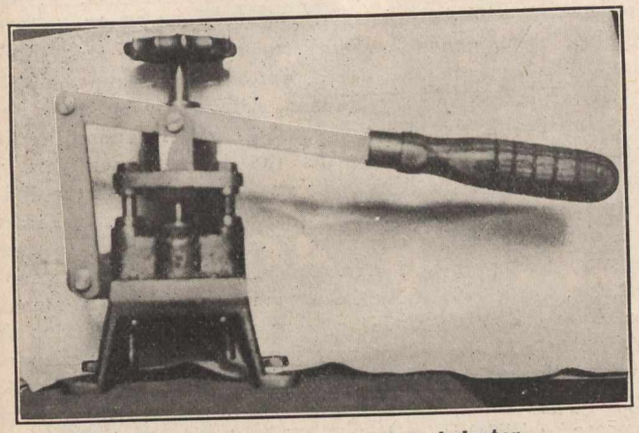


Fig. 3.—Bullet-sizer and Lubricator.

gear having 24 teeth. (This small machine develops 1-10 horse-power at a speed of 1,800 revolutions per minute. The wheel is 2½ inches diameter, with 40 blades; and a small 500 volt arc light. Mr. Graham makes many interesting experiments, and is not averse to following up mechanical ideas, which are supposed to be impossible, to prove for himself whether they are or not. He takes great enjoyment out of experiments of this nature.

THE UNIVERSAL INDEX AND SPIRAL HEAD.

This head is the result of a desire to fill the need of a spiral head that will, at once, answer the requirements of the heavier duty now imposed on the milling machine and still retain the fine points of accuracy expected from such a tool. In designing this head it has been the object to produce a design that would answer the requirements of the wide range of work met with in ordinary practice without sacrificing any of the desirable features of the older heads, and to add those features that good practice shows would greatly increase the usefulness of the head on general work.

The worm gear is made in two sections so that one section may be rotated on the other to take up the wear on the teeth. This method has long been used, and is the most accurate method of adjusting for wear and also in the hobbing of the teeth in the blank.

The stiffness and rigidity of the construction is shown in the views. This increase in strength has in no way impaired the ease of handling nor made the head at all clumsy or awkward to operate. The design is of an approved type, having the swivel block housed between heavy uprights in which the block swings in a vertical plane. The block is held in any position by means of clamping bolts which draws the outside plates securely against the uprights, making a secure bind holding the head in position against the heaviest of cuts.

The principal feature of the design is the large worm wheel that has been obtained. This gear has been made as large as the respective swing of each size head would allow, and by the design followed it has been made much larger than that of any head so far offered. The large diameter of the dividing wheel adds much to its life, and insures greater accuracy in the work than would be possible with the smaller diameter common to other dividing heads. The large diameter and resulting coarse pitch allows of much heavier spiral cuts being taken without the danger of impairing the accuracy or of distorting the teeth in the gear. The increase in stiffness of the head in general makes possible the taking of much heavier cuts at faster feeds and speeds, obtaining the best possible results with high speed steels.

In bringing out this new head, the idea of making the differential indexing mechanism a component part of the head, has been carried out so that the head may be used as an index or dividing head in any position along the platen with the spindle either parallel with or at right angles to the main spindle of the machine, or in any intermediate position. This has been accomplished by placing the change gears used in differential indexing on the rear side of the head, as shown in the view where the gears are set in position. As seen, the gears have no connection with the table at all, as is the case with the ordinary index head fitted for differential indexing.

With the gears used in differential indexing arranged on the head as is done on this head it is possible to swing the spindle into position for cutting bevel gears or teeth on any conical work. This at once broadens the scope of differential indexing from straight cylindrical work to that which requires the angular setting of the spindle in the vertical plane.

In order that the application of the differential indexing may be universal, it is necessary tht it be made available for use on work with helical or spiral grooves, such as spiral gears. It has been done in this new head. The manner in which it is accomplished is as follows:—

The principle on which the differential system of indexing works, makes it necessary to have the spindle and index plate so connected by means of change gearing, that the movement of the spindle will cause a movement of the index plate in one direction or the other as the case may be. This makes it necessary that the index plate be free to move on its axis independent of the index crank during the indexing operation. In cutting spirals, the plate is geared to the lead screw by suitable change gears. The connection between lead screw and index plate must be broken when making the division in order that the index plate be free to make the differential movement with the index crank. This breaking of the connection is accomplished by means of an adjustable clutch which is withdrawn during the indexing operation. After the division has been made, the teeth in the clutch will be found to be in such a position in relation

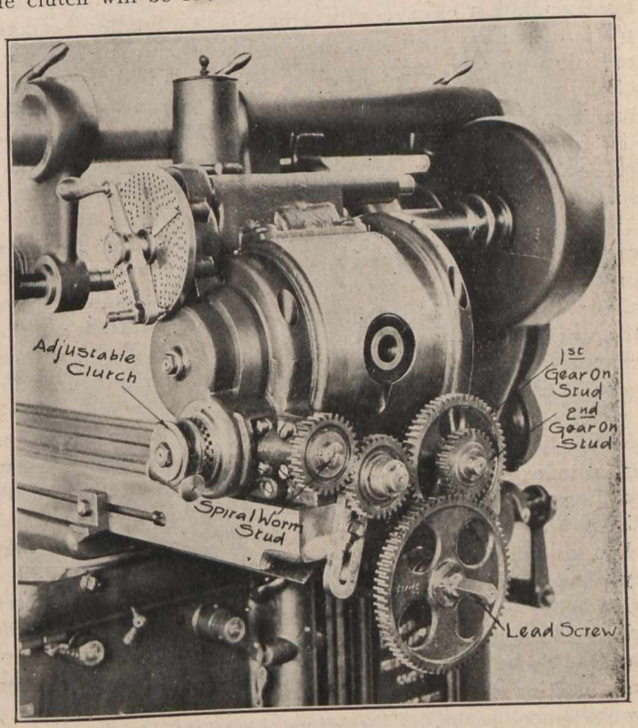


Fig. 1

to the corresponding spaces that it is impossible to engage same. In order to bring the teeth and spaces opposite each other, one half of the clutch is made adjustable so that it may be rotated the required amount to bring the two portions in proper position for engagement. This adjustment is accomplished by means of the knurled knobs attached to the clutch.

The connection between the index crank through the worm, worm gear, spindle, and change gears of the differential indexing mechanism and the index plate when the index pin is in mesh with a hole in the plate would form a locked train, which must be released during the spiral cutting operation. This release is accomplished by means of the knurled knob back of the index plate which operates a friction clutch.

Frequently it is desired to roll the work on its axis a small amount without shifting the dog or losing the position of the index pin, or the amount of roll over may be so that should it be accomplished by rotating the crank, the pin would not come exactly over a hole as would be necessary.

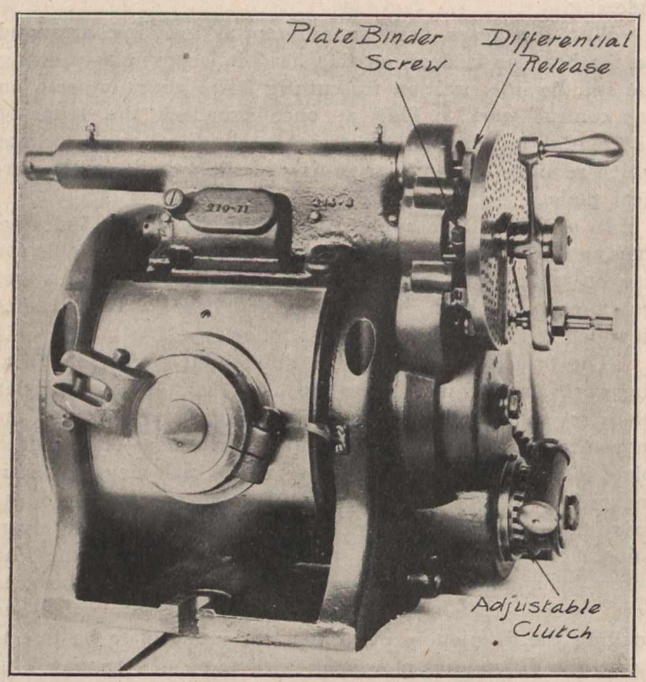


Fig. 2

Should it be attempted to move both plate and crank in conjunction it would be found that the back pin of the ordinary head would not engage with a back hole. In this head the pin is done away with, and the plate is held in position when resorting to plain indexing by a frictional hold on the hub of the plate gear which is clamped or released by a suitable bolt conveniently located. By this means, work may be set regardless of the position of the plate, and the plate can then be securely held in the position it takes when the work is so set.

In work requiring the head to be connected up for spiral cutting the roll over of work is made more convenient by the presence of the adjustable clutch which, as explained above, allows the disconnection of the spiral cutting train so that the spindle and work may be revolved or rolled over without changing the position in relation to the cutter in a direction parallel with the feed motion.

Its stiff and rigid construction. Its large worm and worm wheel of coarse pitch. Arrangement by which differential indexing may be accomplished regardless of the head's position on the machine platen. Arrangement by which differential indexing may be accomplished on other than plain cylindrical work, such as bevel gears. Arrangement by which differential indexing may be accomplished on work with helical grooves such as spiral gears. Arrangement by which the spindle and work may be rotated independent of the lead screw when the change gears are set for spiral milling, making the setting of the work much easier than it would otherwise be. The adjustable clutch for facilitating the above operation. The index crank with handle for rotating same separate from the index pin, giving a crank of the same throw regardless of the position of the index pin, and eliminating the danger of the pin dropping on the plate while revolving the crank. The single reversible index plate for all divisions. Adjustable dial on the spindle nose for obtaining angular divisions in degrees for work requiring no great accuracy. Means for taking up wear in worm gear or dividing wheel..

THE ST. LAWRENCE SHIP CHANNEL.

The St. Lawrence ship channel is one of the most important factors connected with Canada's shipping. The Government recognizes this, and improvements are being made to the waterway in order to minimize the dangers to navigation between Montreal and the sea. The channel is being deepened, straightened, and widened. Mr. F. W. Cowie, C.E., Chief Engineer of the Montreal Harbour Commission, has a general supervision of the work, and under him D. W. Forneret, C.E., is resident engineer of the channel.

It is not infrequently claimed, particularly by those not acquainted with the situation, that Montreal cannot in the future maintain its position as the foremost sea port in Canada, owing to the increasing size of vessels, and the difficulty or impossibility of making the channel to Montreal safe. It is not probable that this state of affairs will come to pass for a very long time, if ever. When spoken to on this subject, Mr. Cowie said, " By the expenditure of time and money the channel may be made any size which the conditions of navigation and the future may demand." Past experiences go to show that this is no idle statement. It is certain that, with an expenditure which would be more than justified when compared with that undertaken in other countries with a much less hope of success, the channel could be made to accommodate vessels very much larger than those now calling at the port of Montreal.

Since 1884, at which date the first dredge was put in operation, up to the end of the fiscal year 1905-6 only $9,000,000 was spent on the St. Lawrence channel, and of this expenditure, equipment to the value of $2,000,000 still exists. When it is remembered that the St. Lawrence is one of the longest inland channels available for ocean going vessels in the world, this sum. compared with what has been spent in other

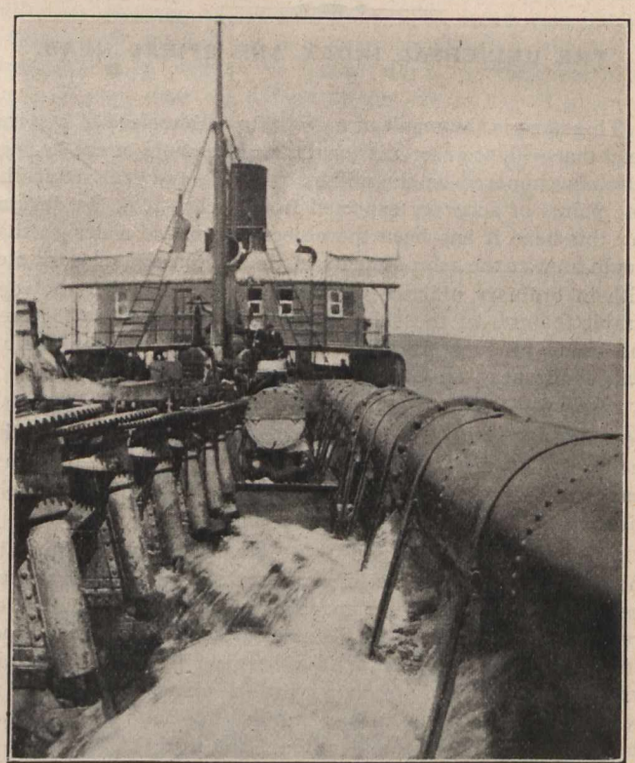


Fig. 1.—The " Galveston," looking aft, showing water pouring from openings in long pipe into hoppers... The gearing operates the hopper doors.

countries on channels of much smaller dimensions, for instance, the Manchester ship canal on which about $80,000,000 was spent to complete thirty-five miles for inland navigation, it will be seen that for the splendid results obtained, a minimum amount has been spent in improving the St. Lawrence.

Up to the end of June, last year, over 48,000,000 cubic yards of material had been removed from the channel. This work was accomplished under many unfavourable conditions, such as swift currents, and heavy storms, which frequently made it necessary to cease work. The dredges below Quebec

are only in operation about half the time, while those above average, probably, three-quarters of the time.

At present there is a channel thirty feet deep from Montreal to the sea. Work is being done in Lake St. Peter, and at several points below, and with the exception of a short distance in Lake St. Peter, the channel is now 300 feet wide

Fig. 2.—" Galveston " Suction Pipe on Board... The gentlemen, beginning at the left are: F. W. Cowie, V. W. Forneret, A. Beauchemin, Superintendent of Dredging below Quebec; Captain Caron, and Chief Engineer Lecroix, of the dredge.

in the straight portions, and 450 feet and over on the curves. The intention is to make the straight portions 450 feet, and the curves 500 to 800 feet wide. Below Quebec at Crane Island, Beaujeu Bank, a channel 1,000 feet wide, with a minimum depth, at extreme low water, of 30 feet, is being dredged. The channel is now well lighted and marked out by means of buoys, but it is the intention to increase its safety and efficiency in this as well as other respects.

In the work of deepening and widening the channel, several types of dredges are used, each being specially adapted for the class of work in which it is engaged. There are six elevator dredges which are used for any kind of material, whether hard or soft. These are often efficient and economical, and leave a clean bed.

A spoon dredge is now under construction at Sorel for Cap a La Roche. This type is specially adapted for use in dredging berths, and in general harbour work where anchors and moorings are not needed. They will work effectively on almost any kind of material, and in many cases are found to be the most economical in operation. At the present time there are no spoon dredges operating in the channel, but several may be seen in Montreal harbour. One hydraulic dredge is in use, viz., the " Tarte," and another, the " Beaujeu," is being built in the government shipyards at Sorel. This latter will be a modification of the suction dredge, a cutter head being added. This cutter will break up material, allowing it to pass through the suction pipe more easily.

The " Galveston " is the only suction dredge operating in the channel. It is at work below Quebec, near Crane Island. This dredge deposits the material in large hoppers, which when full are taken to some selected spot and the material is deposited at the bottom of the river again. The other dredges mentioned are all working above Quebec, the " Tarte " being in Lake St. Peter.

Recently, in accordance with instructions from the Hon. Mr. Brodeur, Minister of Marine and Fisheries, a representative of the Canadian Engineer, along with other gentlemen, was invited by Mr. Cowie to accompany him and Mr. Forneret on a trip of inspection down the river, on board the government steamer " Frontenac." The trip lasted two days. At Sorel, where the first stop was made, an opportunity was given to inspect the government shipyard, which is under the directorship of Mr. G. J. Desbarats. Here was seen the new steel hopper dredge, " Beaujeu," in course of construction. When completed, this dredge will be the largest of this type built in Canada, and will be one of the largest hopper dredges in the world. The hull of the " Beaujeu " is 250 feet long, 45 feet wide, and 20 feet deep, drawing 15 feet of water when loaded, and she is fitted with twin screws. The dredge was launched on December 1st, and it is expected that she will be ready to go into commission early this fall. It is estimated that she will cost about $350,000. It is proposed to operate the new dredge at the St. Thomas Flats, Beaujeu Bank, Crane Island, where the channel requires to be widened, deepened, and straightened. This dredge will be the second of its kind operating in the St. Lawrence, the other being the " Tarte," which, as already stated, is now at work in Lake St. Peter. She is designed for work in soft clay and sand, and the suction pipe is fitted with a cutter head used for breaking up the material. This cutter revolves in a similar manner to a large bit. Some idea of the sizes of this cutter may be gathered from the fact that it weighs 10,900 pounds, and the shaft for operating it is 8 inches in diameter, and 76 feet long, weighing 13,295 pounds. The hoppers have a capacity of 2,000 cubic yards, and the dredge will cut at a depth of 65 feet below the water line.

It is interesting to note that very shortly construction of a dipper dredge for use in Cap a la Roche Channel will be commenced. This dredge will work on shale rock, and the dipper will have a capacity of 10 cubic yards. It will be one

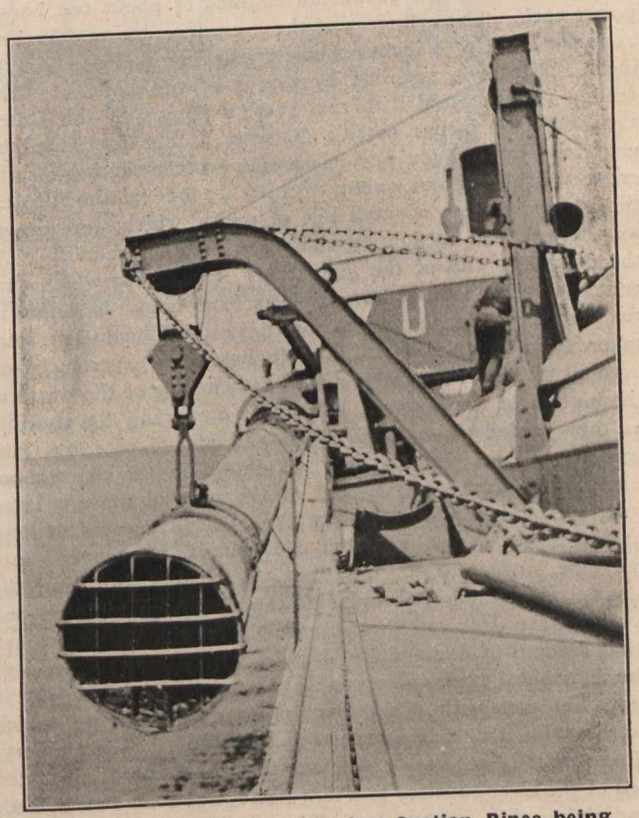


Fig. 3.—" Galveston," showing Suction Pipes being lowered over side.

of the largest and most powerful dipper dredges in the world, having a direct bucket pull of 180,000 pounds.

The second stop was made in Lake St. Peter at the dredge " Tarte." This dredge is one of the most efficient of the fleet, and has a very fine appearance. The " Tarte " pumps the material excavated through a line of floating pipe

where those in charge see fit. On days when there is a strong wind blowing, it is almost impossible to operate this dredge. A record of the "Tarte's" operations for the season 1907 is given in the following table:—

Week ended.	Hours	Hours working.	Thickness of cut (ft.)	Width (ft.)	Advance (ft.)	Quantity (cubic yds.)
May 18	134	97½	21	170	510	84,150
" 25	134	94½	21	225	440	96,250
June 1	134	93	22	300	310	94,550
" 8	134	88½	22	325	280	92,750
" 15	134	112	22	350	350	124,690
" 22	134	102½	22	370	330	124,160
" 29	127	98	22	370	300	112,870
July 6	108	105	22	370	330	124,160
47 days	1,039	791	..	..	2,850	853,580

Average, 18,000 cubic yards per day.

A stop was made at Cap a la Roche, where the dredges operating are of the elevator type. On the second day a stop was made at the dredge "Galveston," operating at Crane Island. At Cape Rouge could be seen the preparations for a large aqueduct, which is being constructed for the Grand Trunk Pacific. At the point where the "Galveston" is working, it is the intention to make the channel 1,000 feet wide, and 30 feet deep at extreme low water. The "Galveston" was purchased in the south by the Canadian Government, and was brought up the Atlantic coast under her own steam. She is a steel twin-screw, suction, hopper dredge, and is well adapted to the work she is now performing. At this point the river bed is composed of clay and gravel. This dredge is 233 feet long, 39 feet wide, and 15 feet 5 inches deep. When loaded with 1,800 tons, she draws 14 feet 9 inches aft, and 13 feet 1 inch forward. She is fitted with two triple expansion engines of about 600 horsepower each. The cylinders of these engines are 15¾ inches, 25 inches, and 37½ inches diameter, having a stroke of 17¾ inches. Steam is supplied by means of two boilers. The dredge is also fitted with two suction pumps of the Dutch type, 8 feet 6 inches outside diameter. She is lighted by electricity throughout, and has ample accommodation for the crew, which numbers twenty-eight. In one of the illustrations may be seen a small pile of rocks, which were drawn up through the suction pipe along with other material. At the discharge end of the pipe, there is a screen which prevents stones and other large objects from being deposited in the hoppers, and the rocks shown in the illustration were taken from this screen. Trouble has been experienced on account of stones interfering with the closing of the doors at the bottom of the hoppers, as well as damaging the turbine, as they passed through it. When the dredge was first purchased only the vertical bars, as shown in the illustration, were found at the suction end of the pipe to prevent large rocks being taken in. A short time since, however, a long narrow stone, weighing about 200 pounds, was sucked into the pipe, and went through into the turbine, breaking the blades. A portion of the turbine that had been replaced was lying on the deck, making it possible for the visitors to see what amount of damage had been done. After this accident the horizontal cross pieces were placed on the end of the pipe, but even with this protection rock is drawn up, which occasionally makes it necessary to stop the machinery. However, it is not very often that rocks are found, since the bed of the river consists to a large extent of coarse sand, and, underlying this, sticky clay. This suction pipe is four feet in diameter, and it is so arranged that it can be operated within a circle, having a radius of 90 feet. The dredge has a record of raising 1,350 cubic yards of material in forty-five minutes. Figure 4 shows the suction pipe partly submerged In this illustration is to be seen the leather joint which permits of adjustment between the suction pipe and the elbow, which is shown curving inwards just past the crane. As will be readily understood, the leather joint receives very hard usage. It is alternately being dried in the sun, and soaked in the water, and in its capacity as a hinge, is almost always in constant motion. It has also to resist the same pressure as the pipe does, and, even with this hard usage, has only to be replaced once a season. It is made from a very heavy hide, put through a special tanning process, and can only be procured in Dusseldorf, Germany. The "Galveston" has a daily capacity of about 4,200 cubic yards per day.

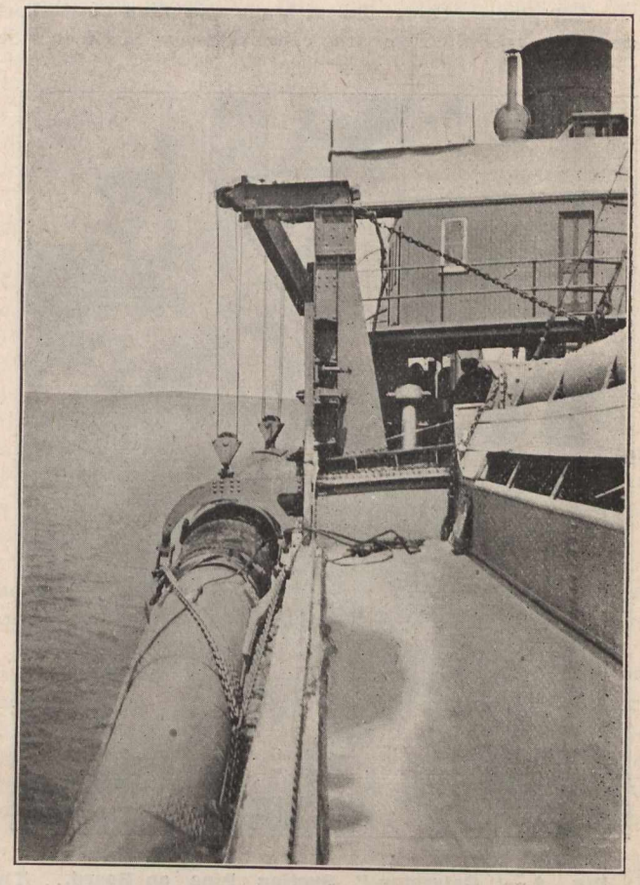


Fig. 4.—Suction Pipe partly submerged, showing leather joint.

THE SEWAGE DISPOSAL PROBLEM AND, IN CONCLUSION, A DESCRIPTION OF THE SEPTIC TANK SYSTEM.

By H. D. Wyllie, C.E.*

The most reliable text books on the subject of sewage disposal, prior to Mr. Cameron's introduction of the septic tank, were Santo Crimp, Rafter & Baker, and Waring. The various methods of sewage disposal, then recognized by sanitary engineers, were classified under the following headings:—

1.—The use of privies and cesspools.

2.—Collection by pail systems.

3.—The pneumatic systems of Liernur, Berlier, Shone and others.

4.—Simple subsidence or sedimentation.

5.—Simple filtration through some artificial substance, as coke, excelsior, or ashes.

6.—Discharge of crude sewage into tidal or other large bodies of water.

7.—Chemical precipitation.

8.—Broad irrigation.

9.—Intermittent filtration.

10.—And finally, electrolysis, although this method, while promising good results, was considered as in the experimental state.

Nitrification or oxidation was invoked at all stages, while putrefaction was just as assiduously avoided; in fact, the

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whole trend of thought and attention of those pursuing the development of the art of sewage disposal was directed towards the accelerated processes of oxidation.

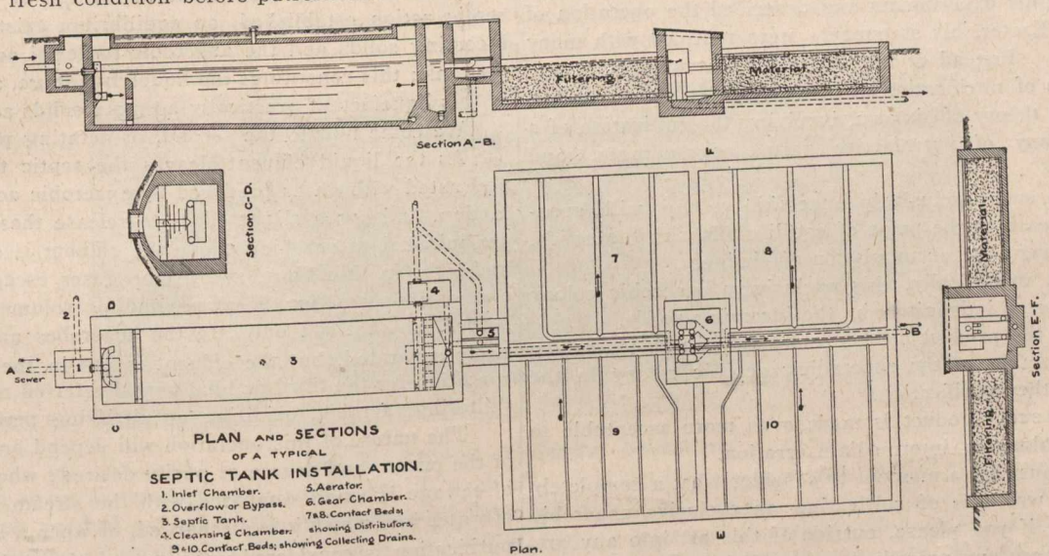
In carrying out these processes all the authorities persistently advised the preliminary removal of sludge as an indispensable element of sewage purification, and that, too, while in a fresh condition and before putrefaction had set in.

Rafter & Baker's book, 1894, provides, as one of the conditions essential for success, "that the arrangements for removing the sludge be such as to ensure its frequent removal, for if left in the tanks until putrefaction sets in, the sludge is likely to rise to the surface, giving off foul odors."

Santo Crimp's book, 1890, says: "The first and absolutely essential preliminary to the adoption of any method of treatment by precipitation is to arrange for the systematic removal of the sludge from the works. To begin sewage treatment without this is to end in the creation of a gigantic nuisance and become involved in an almost hopeless struggle to suppress it."

Waring's book, 1894, and later edition of 1896, always and everywhere carefully enunciated the principle that sewage must be purified by means which are put into operation before decomposition had set in. He says: "In practical work two cardinal principles should be kept in view and should control our action.

"A.—Organic wastes must be discharged at the sewer outlet in their fresh condition before putrefaction has set in.



PLAN AND SECTIONS OF A TYPICAL SEPTIC TANK INSTALLATION.

1. Inlet Chamber.
2. Overflow or Bypass.
3. Septic Tank.
4. Cleansing Chamber.
5. Aerator.
6. Gear Chamber.
7 & 8. Contact Beds; showing Distributors.
9 & 10. Contact Beds; showing Collecting Drains.

Fig. 1.—Plan and Sections of Typical Septic Tank System.

"B.—They must be reduced to a state of complete oxidation without the introduction of dangerous or offensive decomposition."

The tendency to putrefaction had been the cause of all the great difficulties of sewage disposal, and putrefactive germs were looked upon as enemies by sanitary engineers just as typhoid germs are looked upon as the enemies of physicians. So deeply rooted was this non-putrefactive idea in connection with all known methods of sewage disposal, that Santo Crimp in his 1890 edition expressed as his fondest hope that some chemical might be discovered that would kill the putrefactive germs without injury to the nitrifying organism. He says: "The chemist should and probably will be able to indicate what re-agent is inimical to putrefactive germs yet not destructive of those ferments which complete the destruction of dead organic matters by resolving them into innocuous gases and minerals." He adds: "It is not too much to hope that its solution is within measurable distance."

Disposal of House-Wastes.—The disposal of house-wastes as distinguished from sewage disposal must of course be considered separately, because they are so largely charged with oxygen.

Louis Mouras in 1881 introduced in Paris his "automatic scavenger" to prepare the house-wastes for the sewer, foecal matter not being admitted into the sewers until some time later; this he did by arresting the solids in a cesspool or catch basin until by dilution with an abundance of water, and maceration, they were so diluted or comminuted as to flow with ease into the main sewer. In 1887, however, foecal matter was admitted to the Paris sewers for the first time, doing away with the necessity for the "automatic scavenger," and it was consequently abandoned.

In ordinary practice if a sewer is available for connection with the house-drain, the question of disposal is settled, but as often happens in the case of isolated residences, country homes and the like, no sewer is available and the question of disposal becomes one of vital importance. For use in such cases Col. Waring advocated the construction of a tank similar in some respects to Mouras' automatic scavenger, with a flush tank in connection with sub-surface irrigation whenever practicable. In practice, however, he found the flow of house-wastes into the tank had at times sufficient force to so disturb the deposits as to cause a considerable amount of semi-solid matter to pass over into the flush tank and thence into the irrigation channels, resulting in their becoming clogged. In order to reduce this disturbance, Col. Waring introduced a dividing wall so as to confine this excessive agitation to the first compartment. This arrangement he found practically inoffensive and safe, and although he had to admit that a certain amount of putrefaction was inevitable, he relied on the frequent renewals of the small volume of sewage it contained to reduce the amount of putrefaction to a minimum.

Gehrhard, in referring to this device says: "It should be remembered that the liquid sewage in the intercepting chamber is constantly changed; a large volume of sewage passing through it every day, and that although it retains organic waste matter partially putrefied, the amount is not to be compared with that in a cesspool." He adds: "that by cleansing the intercepting chamber once a month the amount of liquid putrid matter may be kept down to a minimum."

In both Mouras' automatic scavenger and Waring's improvement thereon, whatever decomposition of solids took place was the result of dilution and maceration; whatever bacterial action existed was aerobic, and must not be confounded with the anaerobic, putrefactive or liquifying action which takes place in a septic tank. Naturally there was some putrefaction in the stagnant recesses of these chambers, but this putrefaction, although unavoidable, was always considered highly objectionable, and both Mouras and Waring depended on frequent flushing and the consequent introduction of oxygen, to remove it and prevent its becoming a nuisance. This is evidenced by their own writings.

In Mouras' French patent, he says: "But we must carefully note that the discharge pipe never passes anything but turbid water holding in dissolution a certain quantity of matter coming from the decomposition and disaggregation of matter going on at the bottom of the tank.

"For the proper working of the apparatus it is expedient to discharge into the receiving pipe, as much as possible, rain

water and dish water; in short, all water that can be disposed of in order to facilitate in the tank the decomposition and disaggregation of foeces and all other decomposable matters which may chance to be there."

Col. Waring, in describing his device in 1894, says: "In so far as the decomposition is necessary, the settling-basin is, in a less degree, subject to the theoretical objections that are made to the cesspool. It is, however, to be considered that this settling-basin, which is perfectly tight as to its walls, is so small that the volume of water passing through it takes up the products of decomposition, and carries them on to the drains before they assume a condition at all comparable to that of the permanent cesspool. It is found, practically, that the arrangement is inoffensive and safe." He adds further: "The aim should be to avoid putrefaction and secure as nearly as possible a complete and rapid resolution with a sufficient supply of oxygen."

In the disposal of house-wastes therefore, as in the disposal of sewage, all authorities agreed that nitrification or oxidation was essential throughout, and that putrefaction, always objectionable, must be avoided.

The Septic Tank.—At a time when the attention of sanitary authorities and the most advanced thinkers on this subject, including the Massachusetts State Board of Health, was directed to nitrification or oxidation as the ne plus ultra of sewage disposal, Mr. Donald Cameron was working quietly in an opposite direction, and when in 1895, he published the result of his experiments and described the operation of his tank at Exeter, his statements were received with many reservations. Instead of following the beaten path, or unbroken chain of nitrification or oxidation, Mr. Cameron had worked out a theory of his own, involving the cultivation of a separate colony of putrefactive germs or anærobes, and ascertained:

1.—That such exclusively anaerobic colony will spontaeously increase to the point of equilibrium with the solids, and thus prevent the accumulation of sludge.

2.—That, reciprocally, this exclusively anaerobic colony will be supported indefinitely by the incoming solids.

3.—That the product of this exclusively anaerobic colony will be acceptable to the succeeding aerobic colony in the filter, for further purification.

4.—That such product is made even more acceptable to the aerobic colony by intermediate aeration.

Let us pause for a moment to consider what a completely pioneer idea was this of cultivating an exclusive anaerobic colony. Go, if you please, outside of this art into any art. Where was there any precedent or parallel for the idea that any germ which individually was pernicious could be made useful by being colonized? So far as we know, in the case of every other pernicious germ the greater the number the the greater the evil, but here Cameron ascertained not merely that the greater the number the lesser the evil, but that when the number was increased to the maximum the evil was reversed into good.

The Cameron process was such a radical departure that for a time everybody was skeptical; by sheer force of merit, however, it was finally accepted as the most modern and the most efficient system of sewage treatment, although so revolutionary in its character. The extent to which the sewage world was started by Mr. Cameron's reversal of all previous methods is well illustrated by the fact that there were two public inquiries made at Exeter, England, by the local government board; it was made the subject of debates and discussions before scientific societies all over the world by engineers, chemists and bacteriologists. It was heralded as a new process, a wonderful discovery, and the beginning of a new epoch in the art of sewage disposal; even a new word in the art of sewage disposal was coined to designate Cameron's discovery, namely, the "Septic Tank" system.

This system consists of a tank of suitable dimensions, and so arranged that a mass of putrefactive organisms or anaerobes are developed therein of a character and quantity sufficient to liquefy the solid matter of the flowing sewage. It involves the complete separation of the anaerobic or putrefactive germs from the aerobic or nitrifying organisms, so that the work of both is performed unimpeded by the presence of the other; the septic tank is the work-shop of the anaerobes, where ideal conditions are provided for their development and activity, i.e., the absence of air, light and agitation; while in the contact or filter beds these conditions are completely reversed, and an ideal home for the development and activity of the aerobes is provided. The result accomplished by the Cameron process is the liquefaction and purification of sewage on a practical and efficient scale, "avoiding the formation of sludge."

It may be divided into three periods:—

1.—The septic, liquefying, putrefactive or anaerobic period.

2.—Aerating period.

3.—Filtering, aerobic, oxidizing or nitrifying period.

The first of these, or the septic period, involves two stages:—

A.—The maturing or ripening stage.

B.—The liquefying stage.

The length of time that the maturing or ripening stage will take to develop varies, because it will depend on the character of the sewage to be dealt with and other varying conditions, but with an average sewage under normal conditions, substantial septic action will not be completely established in less than from 6 to 12 weeks, and during this time there will be a rapid, but decreasing, accumulation of solids in the tank. When the maturing stage is complete, and septic action established, an equilibrium exists between the incoming solids and the anaerobic bacterial action set up in the tank; this constitutes the liquefying stage, and as a result of this liquefaction practically no more solids accumulate.

We come now to the second, or aerating period:—

As the liquid effluent leaves the septic tank it is impregnated with gases produced by anaerobic action, or putrefaction, and has a slight odor; to release these gases which are inimical to aerobic action, the effluent is exposed to air and light in thin films, and as the gases escape during this exposure or aeration, a corresponding volume of air is absorbed, so that not only are the anaerobes and aerobes entirely separated, but the effluent is put in the best possible condition for the third or final period referred to above as the "filtering, aerobic, oxidizing or nitrifying period."

The nature of this operation will depend on the character of the outlet, and degree of purity desired; where the volume of sewage is small compared with the stream or other body of water into which it is discharged, or when a high degree of purification is considered unnecessary, the tank effluent may be discharged without further treatment; when on the other hand, a higher degree of purification is essential, local conditions will determine whether aerobic bacterial contact, sand filtration, or irrigation shall be resorted to, and to what extent.

Aerobic bacterial contact consists of two or more beds, constructed preferably of concrete, so as to be made watertight, and filled with suitable material, such as coke breeze, cinders, or furnace slag, screened and freed from dust and fine particles. They are filled alternately, allowed to stand full from one to three hours and then emptied by means of suitable valves; as the sewage leaves the bed the air is drawn down into the interstices of the filtering material, so that it is thoroughly aerated before being again filled. This alternate filling, emptying and aeration is controlled by an automatic alternating gear, so that the operation is not dependent upon the fidelity and vigilance of an attendant.

Sand filtration and irrigation, the other methods of subsequent treatment, are too well-known and understood to need explanation.

It is impossible to lay down exact rules defining the dimensions and proportions of septic tanks, or as to the most desirable method for the subsequent treatment of the tank effluent; these are matters that depend not only on the character of the sewage to be dealt with, but also on the nature of the outlet and local condition generally. For these reasons, each case must be considered independently in order that due benefit may be derived from any natural advantages that may exist locally as affecting the efficiency or economy of an installation.

A SEAMLESS DRAWN STEEL BATH TUB

The accompanying illustrations show the product and operations of what is said to be the largest piece of work of the kind produced on this continent by the toggle-press method.

The drawing is done cold in three operations. There is only one intermediate annealing process. This is necessary to restore ductility to the rim to avoid any possibility of fracture in the third or rim-rolling operation.

The plate is a plain squared sheet of mild steel $\frac{1}{8}$-inch thick. The product of the first operation is shown by Fig. 1. The product of the second is shown in Fig. 2. This is a completed tub as far as the drawing is concerned. In Fig. 3 we see the tub finished as far as the metal working goes, except the punching of small holes for the supply and waste pipes.

The time required for the three operations is not over three minutes.

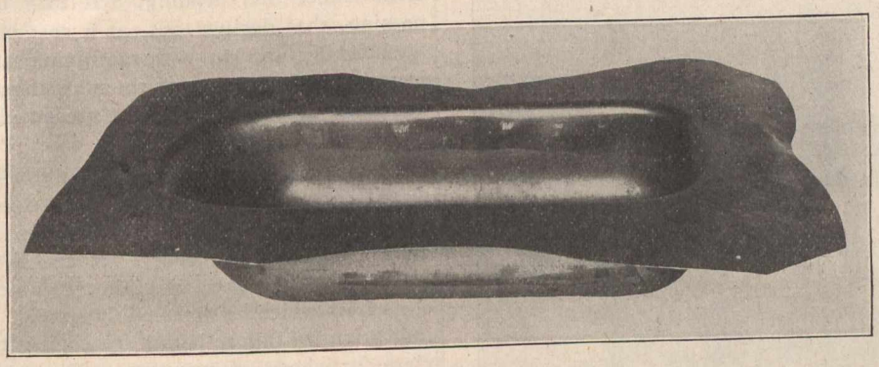


Fig. 1. Product of First Operation.

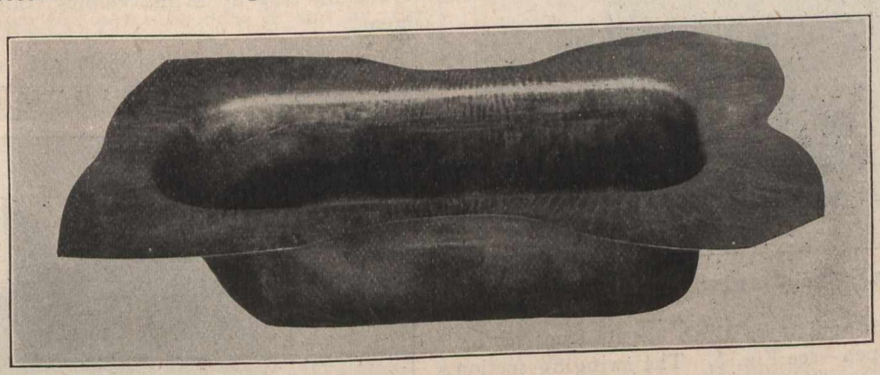


Fig. 2. Product of Second Operation.

The Drawing Press.

In Fig. 4 we see the drawing press. This machine is fitted with two steam cylinders distinctly separate in their functions. The smaller is located on the right hand and operates and controls the blank holder.

The blank holder has a vertical motion of 19 inches, and is actuated by four toggles, one at each corner. Their combined pressure is estimated to be 1,400 tons. The toggles are connected in pairs to two horizontal shafts running from right to left, one on the front and the other on the rear of the press. These shafts are connected outside of the housings at the right hand end to the piston rod by means of bell cranks and links. The control of this blank holder is independent of the other movements of the machine.

The main steam cylinder which operates the forming plunger is 28 inches in diameter. Its piston stroke is 50 inches. The piston rod is attached to a steel cross-head which weighs 6,000 pounds. To this is keyed the forming punch, which with the cross-head gives a falling weight of about 20,000 pounds.

The base or anvil is made in three sections, having a combined weight of 90,000 pounds. The main arch, the cylinder, and the housings or uprights are bolted together on the base, and are strengthened by four rods passing through all of these members. These rods are shrunk into position. Some of the general dimensions of this press are: width between housings 96 inches, bed 60 x 96 inches, extreme height, 23 feet, and total weight, 260,000 pounds.

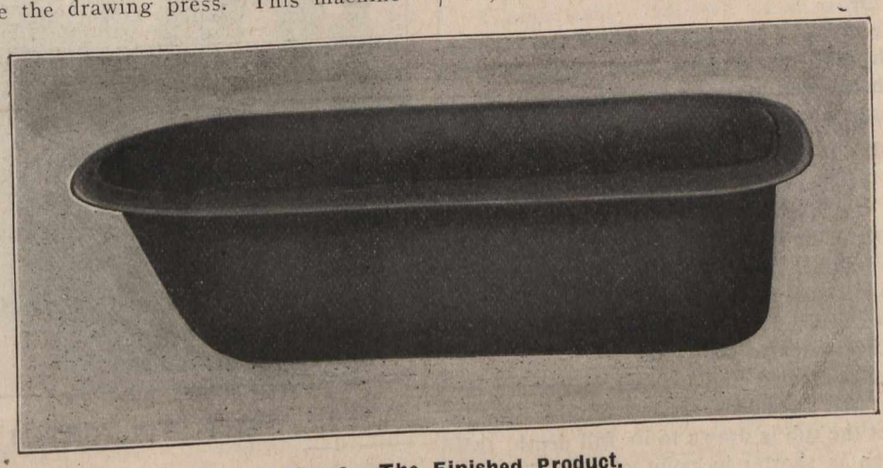


Fig. 6. The Finished Product.

The Drawing Dies.

The drawing dies and attachments were designed to give the metal the greatest protection possible, to avoid the forming of wrinkles or buckles in the sheets. The results are such that no spinning or ironing process is necssary as a finish. The drawing die is adjustable and serves for three lengths of tubs. A separate punch, however, is required for

each length. The lower die is fitted with an automatic knock-out operated from the blank holder, for ejecting the work when the operation is finished.

The Trimming Press.

The half-tone Fig. 5, shows the double back-geared power press used for trimming and rolling the rim. It is

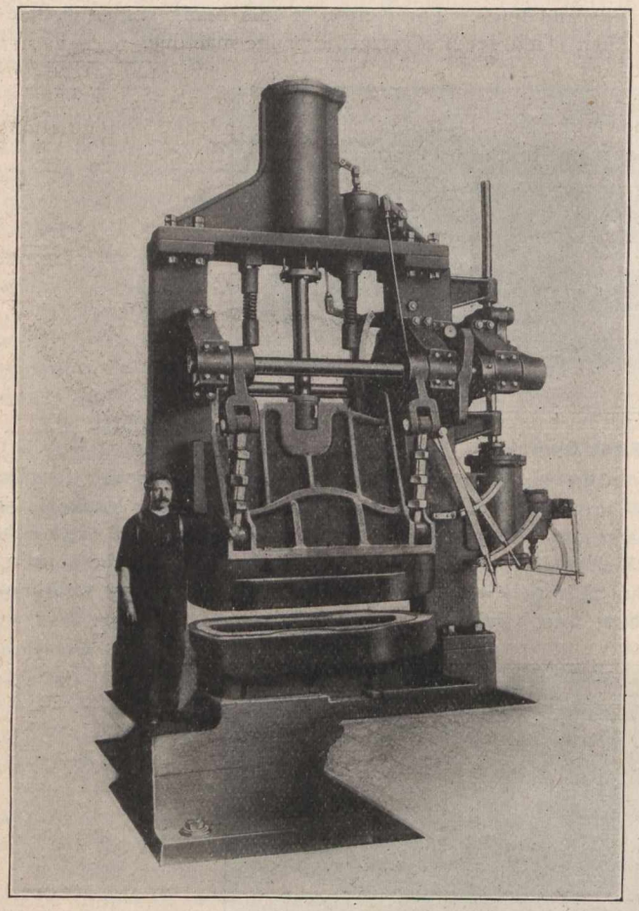


Fig. 4. The Drawing Press.

fitted with a die holder or fixture, which has its front section hinged and made to open—see Fig. 6. The swinging section is provided with a positive locking device.

The press slide is fitted with a positive automatic knock-out, passing through the punch. As the slide lifts with the stroke of the press, this knock-out is brought into action stripping the work from the punch. The bed is also fitted with an automatic knock-out, cam actuated, which is timed to rise with the slide. The cam is on the left hand end of the crank. This knock-out device receives the work when it is forced off by the knock-out in the slide, and prevents it from falling back into the die.

Some of the dimensions of this press—which the makers designate as 84-inch No. 96 double-geared special—are: stroke 6 inches, width between uprights 86 inches, bed 48x84 inches, and total weight about 85,000 pounds.

The Operations.

In the first drawing operation the attendant places the sheet in position in the die, and by means of the small cylinder brings the blank holder and pressure plate to bear with the necessary pressure. The large cylinder then forces down the forming punch and draws the sheet to a partially formed tub 12½ inches deep. This should not require more than one and one-half minutes to complete.

The blank is then annealed and pickled to remove the scale, and is ready for the second operation. This is similar to the first, except that the tub is drawn to its full depth, 17½ inches. This operation is shorter in point of time than the first.

The third operation in the power trimming press trims and rolls the rim at one stroke. The time required is less than one and one-fourth minutes. In actual use 48 tubs have been rolled and trimmed in an hour.

The complete equipment was designed and built by the Toledo Machine and Tool Company, of Toledo, Ohio.

MINERAL RESOURCES OF NEW ZEALAND.

Part VI.—Mining Education.

There is not sufficient space at the writer's disposal for this important subject to be treated with the fullness which its importance warrants. Accordingly no suggestion will be made under this heading. It may be noted, however, in passing, that during 1905, at a cost of nearly £24,000,* 232 attended lectures in various mining and metallurgical subjects,† or 2.6 per cent. of the men engaged in mining. Only one-third of these students presented themselves for examination.

Four scholarships are annually offered to students at these schools. No winner has yet taken a place of distinction in either mining or metallurgy, although two occupy good positions in geology. None—so far as the writer is aware—has ever done anything to ameliorate the lot of the class from which he presumably sprang. The reason for these indications of failure is that the competitions fail to attract the class for whose encouragement they are intended—the practical and skillful miner or millman. Why this is so may be briefly indicated as follows:—

(1) £50 (the sum paid to the winner to pay his way at the Otago University—no fees are charged him for tuition) is not enough to tempt a man with any responsibilities away from work for seven months in the year. If the man has worked his way up in his employ, this reason is especially cogent.

(2) The goldfields schools are conducted by highly trained men, and the syllabus is very full. The time a man

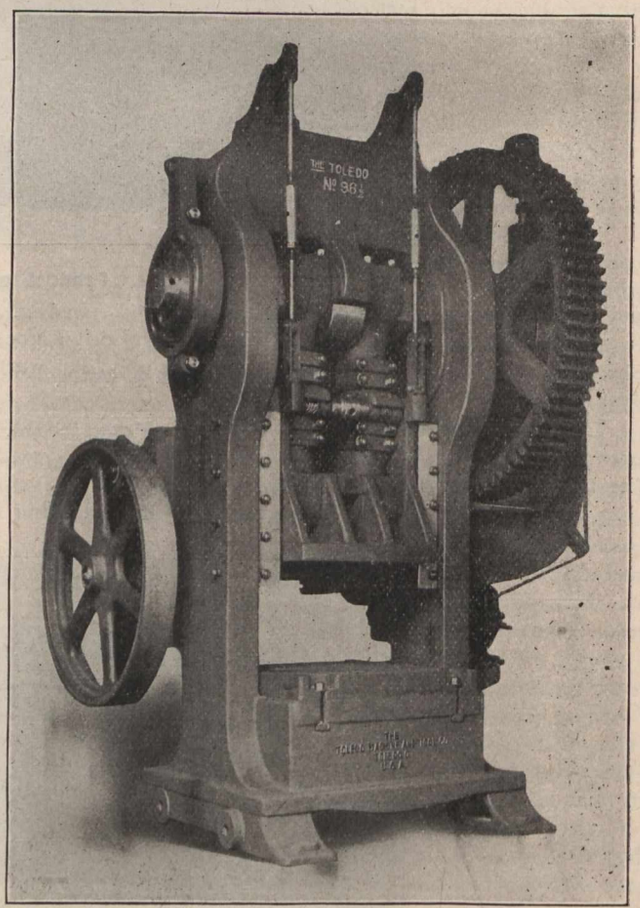


Fig. 5. The Trimming Press.

*Direct cost to the State. No data published as to local contributions, fees, etc. The total expense might be safely estimated at £25,000.

†This is exclusive of school-children, but inclusive of bank-clerks (assaying), school-teachers (mostly chemistry). The figures relate to the goldfields schools of mines in the Auckland and Nelson Provinces. Otago has no school of this class. The Nelson schools at Westport and Reefton serve Westland also.

spends at Dunedin is wasted so far as practical experience for certificates as mine-manager is concerned (1).

(3) The examination is conducted on paper, and covers a large quantity of ground. It thus favors the bookworm in comparison with the budding mining engineer or metallurgist with a real bent for the work.

Abandoned Properties.

Some thousands of metalliferous lodes are known to exist in New Zealand. Many of these are hopelessly poor, and their development has never proceeded very far. Some happened to be discovered at a time when a "boom" was in process of being succeeded by a "slump," and so never received the attention to which their true value entitled them. Others worked with success till a change in the nature of the ore—though not its value—caused a shut-down. Others, again, were run with varying fortune by companies whose finance consisted essentially of a dividend on Mondays and a call on Fridays. With these the slightest contretemps involved a stoppage. Sometimes they would be re-opened on the strength of a levy barely sufficient to pay for retimbering and the erection of a ramshackle caricature of a modern treatment plant. Unless payable returns were obtained at once the mine closed down a second time with another stain on its reputation. To-day those who know the facts have not themselves the capital to operate the mine in a suitable manner, while those who have to trust to the published history of the reef see little to tempt them to invest.

The prospecting of these properties by diamond drills or otherwise is work which will never be done if not by the Minerals Fund.

Subsidized Mining.

Instead of encouraging the under-capitalisation of mining ventures—already too marked in locally promoted concerns—by the loan of money at 4 per cent., it would be better if the state gave a helping hand to some of the small mining companies which have been struggling bravely for years against ill-fortune. Many of these have always "acted straight" with their men, have invariably obeyed the law, have kept their plant in reasonably good order, and, in fact, have dealt faithfully with all. If the people of New Zealand are satisfied that there is national money to spare for the encouragement of gold-mining, it would be infinitely more just to employ it in the direction indicated. Necessary restrictions would be: (1) That the money thus paid must be expended in stores, wages, etc.; (2) that the Minister must have the right of directing the work of exploration carried out by means of the subsidy; (3) that during the currency of such exploration, and for three months before and after, the share-register of the company must be closed for transfer.

Old Battery-tailings.

The early batteries trusted mainly to the amalgamation process in different forms for the extraction of their gold, and what the quicksilver—then or later—did not catch went into the tailings. (That this amount must have been considerable may be deduced from the fact that in modern mills quite 30 per cent. of the total bullion is obtained from chemical processes subsequent to amalgamation (2). In many places these tailings-heaps are being treated with profit, as a simple cyanide plant, complete in every detail, and capable of treating 50 tons per week, can be erected for under £200. The cost of treatment will be about 7s. 6d. per ton under ordinary conditions.

Unfortunately, the existence of many of these heaps is known only to a few local residents, who have neither the capital nor the energy for their exploitation. It is suggested, therefore, that a list of such heaps be published. The time during which the erection of a plant must be completed should be fixed, however, at six months.

Mine-ventilation and Miners' Diseases.

(1) That strict compliance be insisted upon with the existing regulations relating to mine-ventilation.

(2) That as soon as possible a decision be arrived at as to the best form of apparatus to be adopted for the laying of dust during mining operations, and that legislation be introduced to compel, under penalties, its installation in every working-face.

(3) That immediate steps be taken to ascertain whether ankylostomiasis be prevalent among ore and stone miners, and that if any mine be found to be infected its operations be stopped until the mine has been disinfected to the satisfaction of the Minister.

(4) That legislation be introduced providing penalties for any person, whether mine-owner, mine-manager, contractor, tributer, or wages-man, who orders, commits, or knowingly permits the infraction of any of the regulations drawn up for the prevention of miners' diseases.

(5) That the Minister decide upon the nature of the most effective antidotes for cyanide poisoning, and issue regulations compelling their provision in all plants employing the cyanide process.

(6) That legislation which bears the appearance of being directed against individuals be avoided as far as is compatible with proper regulation of the industry.

Mine-ventilation.

One hundred cubic feet—or more if the Inspector considers it necessary—has been fixed as the minimum quantity of air to be supplied to every face for each man working in it. In driving with a machine drill three men are required—viz., one to run the machine, one to stand by the chuck, and one shoveller or trucker working on the rock shot down by the last round of holes. An ordinary 3-inch machine drill exhaust amounts to 85 cubic ft. per minute (3), so that to satisfy the law 215 cubic feet must be brought in by other means. A little—say, 15 cubic feet—may be supplied by leaky joints, and an indeterminate, but certainly small, amount by diffusion and by the slight currents set up by the movements of the miners.

The air-current reaches the level under consideration, and travels along on its way to the upcast. It will only enter the dead end in which the men are working if compelled to do so by bratticing or by mechanical means, preferring instead the road offered to it by the various passes. The fact that a current of air is travelling up a pass anything from 5 ft. to 250 ft. behind them does not benefit the men in the slightest degree. It is claimed by some mine-managers that they ventilate their mines by blowing off compressed air from the pipe-line. If the claim is just, then at each face sufficient air to work two additional machine-drills is expanding without doing any useful work.

The above applies with equal force to the ventilation of rises and winzes, and during the sinking of shafts. Men in the stopes are slightly better off.

Cheap and efficient methods of supplying the requisite quantity of air to the faces will be discussed under "Suggestions" (B).

Miners' Phthisis: Silicosis.

Commissions composed of distinguished savants have been set up in many parts of the world to consider this disease. Many able writers have published monographs on the subject. All have agreed that silicosis is terribly prevalent among quartz-miners. Yet, except in the Transvaal, no legislation—so far as the writer has been able to ascertain—has been introduced, although innumerable suggestions have been made, all with the idea of preventing the suspension in the atmosphere of fine dust produced during the drilling of holes and the blasting of the rock.

In a report prepared recently under Royal authority by three well-known experts (4), the following words are italicised: "The death-rate among machine-men from respiratory diseases was about thirty times and the total death-rate ten times as great as that among colliers of the same age, while the proportion of deaths from lung-diseases among Cornish miners who had not worked rock-drills was about three times

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(1) An Associate of the Otago School of Mines (Mining Division) can, however, obtain a certificate as mine-manager under the Victorian Government. In England, managers of quartz-mines require no certificate.

(2) Compare returns from Inangahua County, where the treatment consists of amalgamation, concentration, and cyaniding, the figures being—for 1905, £126,000 by amalgamation, £41,000 by subsequent treatment.

the normal and the total death-rate 1.8 times the normal of the age in question."

In New Zealand life is generally less hard than in the countries of the Old World, and when a miner in this colony feels that he has "miner's complaint" he ceases to go underground. By dint of help from his relatives and friends, and with a little work from public bodies—who always look with a pitying eye upon such a one—he manages somehow to "rub along." He feels no obligation to report himself as suffering from an infectious disorder (5), and is not, as a rule, confined to his bed till the last bout. (This, however, may last two years; but, whether his end be swift or lingering, his sufferings are usually considerable). Often he contracts some other pulmonary complaint, which appears as "cause of death" in the returns of the Registrar-General (6).

The only statistics relating to New Zealand which the writer has encountered appear in a report by Dr. Makgill on phthisis in Reefton, Inangahua County, which says, "We see that at Reefton there is after the age of thirty an increase in the number of cases of consumption among males, whereas among females in Reefton, and among both sexes over the whole of New Zealand, there is a marked drop after that age." He gives the following table:—

	Whole of New Zealand.		Reefton.	
Age.	Males.	Females.	Males.	Females.
0-10	0.5	0.7	0	0
10-30	25.0	28.6	31.2	40.0
30-50	16.6	18.5	34.7	25.6
50 and over ...	3.5	2.4	19.2	16.7

That the disease is prevalent among quartz-miners in New Zealand no one living in a mining district has any doubt. There is no need for the colony to set up a Commission; the subject has already a bibliography of its own. All that is necessary is to decide which of the many devices on the market is the best, taking everything into consideration, and to compel its installation. The South African Commission of 1903 awarded the first prize of £500 to the Britten's atomizer, and the second prize of £250 to the Leyner water-drill. The latter deals only with the prevention of dust during drilling operations, and does not affect its production during blasting.

The General Health of the Quartz-miner.

Quartz-miners appear to tire easily, both mentally and physically. Public movements in mining districts flourish a little while and then die out. The practical miners attending the schools of mines are the least assiduous at their studies. Miners, as a rule, are not inclined to athletic exercises. On returning home from their work they are generally less ready for domestic chores than other members of the working-class. Unless called out by business or social engagements, they usually sit about till bed-time in their digging-clothes. They often complain of headache and palpitation. Generally, they are pale, and move slowly; but a week's holiday improves them marvellously. They soon revert, however, to their former condition.

All these points are doubtless very trivial; but when it is remembered that these men possess, in common with their fellow-citizens, an energetic and sturdy ancestry, there are surely grounds for assuming the possibility of some serious physical disturbance. The paleness might, of course, be attributed to the fact that the miner's work is away from sunlight, and his proneness to fatigue, his headache, etc., be due to gaseous poisoning. It seems to be generally agreed among writers on the subject (7) that more or less carbon-monoxide is always produced during the explosion of nitro-glycerine compounds. When the detonator is small in proportion to the charge, when the ground is wet, or when from any other cause detonation is imperfect, the quantity may be considerable. Some writers consider that varying quantities are produced during the compression of air in presence of oil. As little as 0.05 per cent. in the atmosphere will, in time, produce most unpleasant symptoms. They are: "First, fullness in the head, throbbing in the temples, and palpitation; second, tendency to stagger, indistinctness of vision and hearing, and giddiness. . . . These are more marked when exerting "† This is with a 30-per-cent. saturation of the blood—a stage which may be reached without a man being suspicious of any external influence being at work.

The presence of an appreciable quantity of arsenic in the dust suspended in the atmosphere—arsenic derived from the disintegration of nodules of mispickel in the ore—would certainly produce most of the above symptoms; but in all cases of arsenical poisoning paralysis supervenes, and this condition is rarely encountered amongst quartz-miners.

On the other hand, in view of what has occurred in coal mines at Westphalia and elsewhere, and in tin-mines at Dolcoath, Cornwall (8), there is a distinct possibility that ankylostomiasis (miners' anæmia) may be found in the quartz-mining districts of New Zealand.

The truth of the matter can only be elicited by special investigations, but these need be neither expensive nor complicated.

The following is put forward tentatively as a method of carrying out the necessary tests: A qualified medical man appointed by the Minister—a specialist is not indicated—would meet the shift coming out of the mine, and would select a few of the men showing most marked signs of fatigue. From each of these a few drops of blood would be taken and placed in labelled tubes. Twenty cubic millimetres would be drawn from each sample and diluted to a hundred times its volume with water, a hæmacytometer being employed to insure exact measurement. The samples would then be compared against an equally diluted quantity of blood drawn from a person above suspicion as regards carbon-monoxide poisoning. If the blood of the miner contained HbCO (carboxyhæmoglobin), even to the extent of 18 per cent. saturation—i.e., considerably less than would be required to make the subject conscious of more than a slight lassitude—it would have a readily recognisable pink tinge. The presence of HbCO in the blood of any individual would conclusively prove the mine-air to be contaminated with carbon-monoxide, although a negative result would not be so conclusive a proof of the contrary. If HbCO was detected, the necessary alterations should be made in the ventilation arrangements, and the test repeated at the end of, say, a fortnight. A drop of blood from the sample would be treated with eosin (a coal-tar product) and examined under the microscope, the colored corpuscles being counted by means of a special slide. An increase of the eosinophite variety of leucocytes is generally found in ankylostomiasis, but it is not an infallible proof of the presence of the disease (9). The test might then be repeated without the addition of eosin. Any considerable diminution in the number of red corpuscles—if intelligently interpreted—would establish the existence from some cause of anæmia. Anæmia having been detected, it would remain to determine its immediate cause. Malnutrition would certainly not be to blame, for miners receive a wage sufficient to insure them a proper supply of food. Tests must therefore be made on the fæces of selected cases, any infected persons isolated, and the working of the mine stopped until a simple but effective disinfection has been carried out.

During the period of isolation of the suspects in Westphalia it was the custom of the proprietary to pay in full the wages of the men thus prevented from following their employment. No suggestion is made in this essay with regard to this particular point.

It will be best for the regulation of underground latrines to be left to mutual agreement between employers and miners. In any case the faithful carrying-out of regulations rests with them. If the collective opinion of the mining community is against certain practices, then such practices will cease; but if neither party realises the importance of the matter, then all the regulations in the world will fail to prevent continuance.

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(3) Report of the West Australian Commission on Ventilation. Vide "New Zealand Mines Record," April, 1905. Amount varies inversely with pressure carried.

(4) Dr. J. S. Haldane, M.D., F.R.S.,; Mr. J. S. Martin, H.M. Inspector of Mines, South-western Division of England; and Mr. R. A. Thomas, Manager, Dolcoath Mine, Cornwall.

†Authorities differ, but the majority consider silicosis contagious, claiming that the sputa carry germs capable of propagation in another host.

See additional footnote next issue.

NEW BUILDINGS.

Ontario.

A new building will be erected by the General Electric Company at the corner of King and Simcoe Streets, at a cost of $180,000, Toronto.

Messrs. Schultz Brothers, of Brantford, have the contract for a new building for the Bank of Commerce. It will cost about $27,400.

Mr. George H. Gooderham has purchased a site on Teraulay Street, Toronto, on which will be erected a five storey automobile garage.

Plans have been approved by the Dominion Government for the new central station at Ottawa to be built by the Grand Trunk. The plans include an office building ten storeys high, and the cost of the structure is estimated at between one and two million dollars. Plans have been submitted to the Government for a hotel building in Major Hill Park at an estimated cost of a million dollars.

That the School Commissioners of Montreal have learned the lesson taught by the holocaust last winter, is shown by the action of the Catholic School Commissioners, a short time ago. Mr. J. Venne, architect, submitted his plans for the new Salaberry School, at an estimated cost of $72,000. He reported that for 25 per cent. more he could make the new building thoroughly fireproof, and was immediately instructed to prepare plans of a fireproof building.

The results of the competition of Canadian architects for the prizes, totalling fifteen thousand dollars, awarded by the Government for the four best designs submitted for the proposed new three million dollar departmental block and justice building, to be erected opposite Major's Hill Park, Ottawa, were anounced on August 22nd, by Hon. Sydney Fisher, acting Minister of Public Works. Mr. Edward W. S. Maxwell, of Montreal, was awarded the first prize of $8,000; Darling & Pearson, of Toronto, were given second prize, $4,000; Saxe & Archibald, of Montreal, third prize, $2,000; David R. Brown and and Hugh Ballance, of Montreal, were even for the fourth prize of $1,000. It is likely that the erection of the building will be commenced next year.

Quebec.

Messrs. Baulne, Bertrand & Gagnon, structural engineers, Montreal, are designing two extensive reinforced concrete buildings for a leading manufacturing company of Montreal.

Alberta.

The contract for the new City Hall buildings in Calgary has been signed by the city and the contractors, the sum in the contract being $142,000. The opening ceremonies on construction took place during the past week.

British Columbia.

The building permits issued by the city of Vancouver for the month of July aggregated $1,030,545.

A stone college building will be erected in Vancouver at a cost of $100,000. Bids for construction will be called shortly.

MARINE

Ontario.

Mr. F. J. Yelman, of Toledo, Ohio, who is representing United States capitalists, has been looking for a point on Lake Ontario at which to build a dry dock. He is of opinion that Port Dalhousie would be the best place to build the dock, which, it is said, will be large enough to accommodate the largest steamers and especially those with heavy draught, which now go to the docks in the States and pay extra duty.

Reid Brothers, the Sarnia wreckers, who have in hand the raising of the dredge, "Laurier," which was sunk near Port Hope about three years ago, have succeeded in raising the dredge. She will be brought to the Polson Iron Works, Toronto, and thoroughly overhauled. It is expected that Reid Brothers will raise the "Resolute" which was sunk just outside Toronto Harbor last fall.

Quebec.

The Montreal Harbor Commissioners have purchased a large floating crane for use in the harbor. Heretofore steamship companies doing business at Montreal have had to refuse to carry heavy weights, such as boilers, engines, steel and iron, and a large quantity of such cargoes have gone to the United States.

Nova Scotia.

The Government dredge, "Cape Breton," which was brought from Port Morien to Glace Bay will be engaged for the next few months deepening and widening the channel from the entrance to a considerable distance beyond the Dominion Coal Company's shipping pier. It is the intention at present to have about 3,600 yards dredged to a depth of about 20 feet. The channel will be widened to about 180 feet, which would give the Canada and other large steamers and vessels an opportunity of turning in the harbor with perfect ease, without danger of grounding.

British Columbia.

The Government will have a new steamer built to act as a lighthouse tender. Plans have been forwarded to Ottawa, but have not yet been definitely decided on.

It is reported that a company has been organized to operate a line of steamers between Vancouver and New Zealand ports, and it is stated that operations will commence sometime in October.

Foreign.

An addition to this year's appropriation, $8,000,000 has been asked for by Col. Goethels, chief engineer of the Panama Canal. He says that this amount is necessary to continue the work.

A crew of the United States lighthouse service have been establishing a number of lighthouses along the American side of the Lake of the Woods. Two lighthouses are to be erected at the mouth of the Rainy River, two more are to be built at the mouth of Warroad River, and two more along the shore of the Lake of the Woods. An additional lighthouse is to be erected at Long Point that will excel all the others. Mariners will see its lights from all points at the northern portion of the lake at a range of 20 miles.

TRADE INQUIRIES.

The following inquiries relating to Canadian trade have been received at the office of the High Commissioner for Canada, 17, Victoria Street, London, S. W., during the week ending August 23rd, 1907:—

London firm who import considerable quantities of "wood flour" has asked to be placed in touch with Canadian manufacturers of this material.

Firm of cement manufacturers in the North of England seeks to open up communication with a reliable Canadian importer, with a view to supplying their goods for the Dominion market.

Scotch firm of motor-car manufacturers is desirous of appointing first-class agents, possessing some knowledge of mechanics, at different large centres in Canada. Only firms of influence, up-to-date, sound financially, and able to undertake repair work in this line would be selected.

A Canadian asbestos concern is desirous of opening up trade with Great Britain for such lines as they manufacture, namely, asbestos cement felting and asbestos pipe covering, and wishes to be placed in touch with dealers in the trade, who would be disposed to take up the matter with them.

Mr. A. Stevens, chief train despatcher of the C. P. R. at Vancouver, has been promoted to the position of superintendent at Winnipeg.

The appointment is announced of Mr. G. W. Caye, the chief clerk in the office of the general manager of the Grand Trunk Pacific, Montreal, to the position of assistant to the vice-president and general manager, and purchasing agent of the new system, with headquarters at Winnipeg.

Quebec.

Bids will soon be asked for ties, rails, and bridge construction on the Atlantic, Quebec, and Western Railway, between Port Daniel and Gaspe Basin.

Tenders will be received until the 10th inst. by the Minister of Public Works and Labor, P. Q., Quebec, for the construction of four piers, and the raising of two abutments in concrete masonry, etc., for a fixed bridge to be constructed on the River Richelieu between Chambly Canton, in the County of Chambly, and Richelieu, in the County of Rouville (site of the old Yule Bridge). Ernest Gagon is Secretary of the Department.

New Brunswick.

Tenders will be received up to October 7th for construction of metal superstructure span on Cocagne Mouth Bridge, Kent County. C. H. LaBillois is Chief Commissioner, Department Public Works, Fredericton.

Manitoba.

Tenders are asked until October 15th for the construction of a steel highway bridge across the Souris River at Dunrea.

Bids for the supply and erection of metal lockers for the new police station at Winnipeg will be received by M. Peterson, secretary Board of Control, until September 7th.

The municipality of Riverside, J. H. Putnam, secretary-treasurer, is calling for tenders, which will be received until October 15th, for the erection of a steel highway bridge across the Souris River.

Bids are being received until October 1st by the chairman of the Board of Control, Winnipeg, for the construction of general works and supply of equipment for the hydro-electric station at Point Du Bois.

British Columbia.

The date for receiving tenders on the hydro-electric plant for the City of Revelstoke has been extended until September 30th.

The Provincial Government called for tenders for the construction of an addition to the Industrial School at Nanaimo. They must be in before noon of September 9th.

F. C. Gamble, Public Works Engineer, Lands and Works Department, Victoria, will receive tenders until the 9th day of September, for the erection of buildings in connection with the Industrial School at Vancouver.

CONTRACTS AWARDED.

Ontario.

The first contract for the Trent Canal construction since the recent appropriation was voted for the completion of the Lake Ontario Rice Lake division has been awarded to Brown and Aylmer, a firm which has done considerable work on the canal between Peterborough and Lake Simcoe. This firm has been awarded the contract for section No. 5, from Campbellford to Crown Bay, a distance of about three miles, the contract price being in the neighborhood of $600,000. The contract calls for the completion of the work by November 30th, 1908, but it is expected that fully two years will be required.

Nova Scotia.

The laying of 5,600 square yards of bitulithic pavement at Amherst has been added to the contract previously awarded to the Warren Bituminous Paving Company, of Toronto.

Manitoba.

The City of St. Boniface has awarded an additional contract for 1,400 square yards of bitulithic pavement to the Bitulithic & Contracting Company, of Winnipeg.

Alberta.

The contract for the construction of the new City Hall at Calgary has been awarded to the Alberta Building Co., of Calgary, at a cost of $142,000.

Saskatchewan.

J. G. McArthur has secured the contract for grading 73 miles of railway north-west from Moose Jaw, at a cost of $300,000.

The Bitulithic & Contracting Company, Limited, of Winnipeg, have been awarded a contract for laying 1,900 square yards of their pavement at Regina.

E. M. Paynel, C. P. R. telegraph inspector, is installing a "composite" between Regina and Moose Jaw, by means of which the freight departments will have telephone communication over the telegraph wires. A similar attachment is being fitted between Macleod and Calgary.

British Columbia.

The contract for the erection of an eight-storey warehouse building for David Spencer, Limited, has been awarded to Smith & Sherbourne, of Vancouver, at a cost of $120,000.

The Kootenay Engineering Works, of Nelson, has received a contract from Manager Alcott Payne of the Hewitt Properties, for a double continuous rope tramway, 5,600 feet in length, of a daily capacity of 240 tons.

MUNICIPAL.

Ontario.

The by-law providing for the issuance of $7,000 of bonds for the extension of the city gas and electric light systems at St. Thomas, has been approved by the Ontario Railway and Municipal Board.

City Engineer Rust, of Toronto, has expressed the opinion that the contractors doing the work on the tunnel in connection with the city's water supply will not be able to complete it in the time specified.

British Columbia

It has been estimated that the cost of placing the electric light and telephone wire of Victoria underground will be in the neighborhood of $17,000 per mile.

The material for the steel bridge across Seymour Creek, Vancouver, is now on the ground, and the erection will be commenced immediately. About seventeen tons of steel will be used in the bridge.

OBITUARY.

Albert Havelock Campbell was born in 1867 at Vankleek Hill, Ont., being the son of the late Donald P. Campbell, M.D., who died while his son was a young boy. He lived with his widowed mother in Montreal and was educated at the Royal Arthur and High Schools, graduating from the latter in 1883. He then entered the employ of Frothingham & Workman, wholesale hardware merchants, where he rose to a responsible position, only resigning at the end of 1896 to enter into partnership with William S. Leslie, in the firm of A. C. Leslie & Company, and on the incorporation of the firm at the beginning of 1907, he became vice-president of the company.

In April of this year he had a serious attack of pleurisy, and when apparently convalescent, was taken down with a lingering attack of typhoid fever, being confined to his bed for ten weeks, and his constitution, which was weakened by his previous illness, was unable to stand the strain.

He leaves a widow, the daughter of Mr. John Henderson, city clerk of Ottawa, but no family. His mother, who had always lived with him, also survives. He was a member of the Board of Trade, Dominion Commercial Travellers' Association, Canada Club, M. A. A. A., Y. M. C. A., and St. Andrew's Society, but devoted his time outside of business hours to his home and church.

Among all who knew him personally or in business connections he was very highly esteemed as a true friend, a manly and consistent Christian, and a business man of high character, determination and ability.

Ontario.

A proposal is on foot to build an electric line between Wallaceburg and Petrolea.

The Canadian Northern intend to double the capacity of their coal docks at Port Arthur this winter. When the work is completed the capacity of the docks will be 600,000 tons.

Mr. Alex. Killingsworth, manager of St. Thomas' municipally-owned street railway, has resigned to accept the chief clerkship to chief despatcher Gilhula of the Pere Marquette Railway.

New Brunswick.

The double-tracking of the Intercolonial Railway from Moncton to Painsec will cost about $300,000. The work is progressing very favorably.

Manitoba.

For some time negotiations have been in progress between the Grand Trunk Pacific and Portage la Prairie regarding a joint traffic and railway bridge across the river at that place. These are now off, owing to a change in the company's plans.

British Columbia.

It is reported that the Canadian Pacific will commence the construction of the line from Kamloops to Edmonton immediately.

It is reported that the White Pass Railway will next summer construct a twenty-mile extension of its line from White Horse to the copper camp, and expects to handle at least a thousand tons of ore per day, starting July 1st.

RAILWAY EARNINGS.

Toronto Railway earnings for the week ending August 31st showed an increase of $7,455 over the same period last year. The total earnings were $84,658.

Canadian Pacific earnings for the week ending August 31st were $2,224,000, against $1,962,000 a year ago.

MUNICIPAL.

Ontario.

The ratepayers of Brockville have defeated a by-law to raise $9,000 for improvements to bridges.

The Canadian Independent Telephone Company is making good progress with their construction work. It is expected that the system will be in operation the latter part of next month.

The Order-in-Council has been received by Toronto authorizing the construction of the sea wall in front of the Exhibition grounds. It is now up to the contractors to begin the work as soon as possible.

Quebec.

Tenders will shortly be called for the construction of a sewer for Boulevarde St. Paul, Montreal. The sewer will cost $125,000, and will be constructed according to the plans of Mr. V. H. Dupont, C.E., Montreal.

British Columbia.

The question of placing all overhead wires underground is being given considerable attention in Winnipeg.

The taxpayers of the municipality of Notre Dame de Quebec voted unanimously in favour of the by-law for the new system of waterworks, the plans of which were submitted by Mr Raoul Rinfret, C.E., of Montreal. The work will now be carried out without delay.

Manitoba.

The board of works of the city of Brandon have decided to construct the new bridge to be erected over the Assiniboine River of reinforced concrete.

Saskatchewan.

A by-law recently carried at Weyburn to issue debentures for $50,000 for the purpose of installing a waterworks system.

MARINE.

British Columbia.

A new C.P.R. steamer will be built for the Pacific Coast service, to take the place of the "Princess Victoria."

Messrs. C. G. Johnson & Co., of Vancouver, have commenced work on their new ocean dock at Vancouver. It will be 500 feet long, and have 300 feet water frontage.

The C.P.R., it is reported, intend building a new steamer for the Victoria-Quatsino line. The traffic has increased so rapidly of late that the present steamer is unable to handle it.

Two modern steamships, each capable of carrying eight thousand tons are to be placed on the run between Vancouver and New Zealand direct. A large volume of trade is expected. A vessel will leave Vancouver on the first trip in about two months.

Foreign.

The Berwin-White electrically operated coal docks at Superior, Wisconsin, which were built this season, began unloading coal on August 13th. The docks are not fully completed, but when finished the capacity will be 700,000 tons.

The International Waterways Commission have been asked to investigate the Lake Erie Canal plans, as it is feared the canal would lower the water level in the river St. Lawrence. This canal would run from Lake Erie to the Ohio River, and would take about six years to build, costing approximately $75,000,000.

MINING.

Ontario.

Cobalt ore shipments for the week ending August 31st were as follows:—Buffalo, 100,000 pounds; Coniagas, 160,500 pounds; Kerr Lake (Jacobs), 61,000 pounds; Nipissing, 65,140 pounds; and Trethewey, 65,000 pounds. Total shipments since January 1st, 8,508 tons.

It is reported that native silver and copper have been found on Michipicoten Island in Lake Superior, about fifteen miles from the "Soo."

LIGHT, HEAT AND POWER.

Ontario.

The Hydro-Electric Power Commission has quoted Hamilton a price of about $43 per light for street lighting. At present from $60 to $65 per year is paid for ordinary street lights, and $82 for magnetite lamps.

The Fire, Water and Light Committee of Hamilton has decided to install two electric pumps at the civic waterworks plant, at an estimated cost of $50,000. These pumps will have a capacity of 10,000,000 gallons daily.

Saskatchewan.

The council of Moosejaw is considering a plan to raise $90,000 for improvements and extensions to the municipal electric lighting plant.

NEW INCORPORATIONS.

Ontario.

The Canadian Jack Company, Limited, $25,000. J. W Yakey, M. Riddle, H. H. Calkins, H. Greene.

Quebec.

The Natural Gas Supply Company, $18,000. H. G. Eadie, H. P. Douglas, W. L. Bond, E. Chamberland, M. D. Barclay, Montreal.

The Lachute Graphite Mining Company, $20,000. A. Gaulboult, Z. A. Fournier, Lachute; J. R. Hyer, F. B. Kelly, Watertown.

Ontario.

The new municipal telephone system at Port Arthur is now in operation.

The Royal Gas Engine Company is asking aid from Collingwood in establishing a foundry and general machine shop in that place.

Mr. R. Bigley, the stove manufacturer, has purchased a lot on Sorauren Avenue, Toronto, for $13,000, on which he will erect a new foundry. The lot has a frontage of 227 feet, and a depth of 255 feet.

The Port Stanley Elevator Company, with a capital of $1,000,000, has been incorporated and will erect elevators at Winnipeg, Fort William and other places, as well as materially enlarge the present elevator at Port Stanley. The purpose is to handle all grains for the Erie mills, St. Thomas; Tillson mills, Tillsonburg, and Goldie mills, Ayr, by boat to Port Stanley, all of these firms being interested in the company.

Quebec.

The Colonial Engineering Company, of Montreal, have received orders for Hornsby-Stockport gas engines from the following concerns: Ames-Holden, Limited, and Messrs. Lamontagne, Limited; The Empire Manufacturing Company, London; the City of Chatham for a municipal plant; Anchor Fence Company, Stratford; and the Dominion Brewery, of Toronto.

Manitoba.

The Melita Arthur Telephone Company has just finished installing a party line of some thirteen telephones at Napinka, in connection with the Melita central. The number would have been much greater had Napinka a switchboard, but the company was loath to establish a central in view of the early installation of the municipal system.

Foreign.

A Washington, D.C., report states that several congressmen are advocating Government ownership of telegraphs, as a remedy of the troubles caused by strikes.

TRANSPORTATION AND THE MONO-RAIL.

The principle of the mono-road is not a new one. For the past seventy-five years many engineers have patented various forms of mono-railroads. Mr. Behr claims to have developed only the general ideas and principles of others in designing the practical details, and to have constructed, for the first time, a mono-railroad which has been operated successfully for a number of years, for carrying passengers and freight. Mr. Behr's system was thought of originally in 1883 by Mr. Charles Lartigue, a French engineer.

The principal single rail is laid upon the apex of steel trestles. This rail carries the weight of the car, and does the actual work. Upon the rail, run vertically, and one behind the other, from six to eight large centre wheels, 4½ feet diameter. There are guide-rails on each side of the car with a series of wheels running horizontally, which press on either side of the guide rails, thus preventing the swaying of the car, and counteracting the centrifugal force of the large central wheels, when turning curves. The moment the centre of gravity is placed below the point of support, one of the chief elements of danger is overcome in Mr. Behr's mono-railroad. The main rail is six feet above the roadbed. The main rail, carrying the weight and doing the chief work, is upon the trestles; the two guide-rails, one on each side of the car, and prevent oscillation, and steady the car at curves.

The car is boat-shaped to prevent resistance by the wind, and the motive power is entirely electrical. The weight of the car, including the sixty passengers, is from forty-five to fifty tons. The lock and block system of signalling is used. Professor C. A. Carns Wilson thought the brake was the crux of the whole question of mono-railroad transportation. Mr. Behr uses the Westinghouse brake, and obtains a retardation of 4½ feet per second. To get that figure, a retarding force of 300 pounds per ton is necessary.

The mono-railroad can be built at a cost of twenty-five to fifty per cent. less than an ordinary light railroad. In a hilly country the cost of bridges is twenty-five to fifty per cent. less. The cost for a mono-railroad with a speed of one hundred miles per hour equals that of an ordinary two rail with a speed of only 60 miles per hour. The estimated cost of a high speed two rail railroad, designed to run from London to Brighton, is £12,000,000. Mr. Behr estimated that the cost of his mono-road over the same ground would not exceed £5,500,000.

The technical difficulty is chiefly with high speed at the joints of rails. A one-quarter inch joint opening would be liable to cause a train, weighing about fifty tons, and travelling at a speed of a hundred miles per hour, to become derailed. Mr. Behr claims to have overcome this difficulty by means of the guide-rails with the horizontal wheels. His mono-railroad is running in Germany. A track, too, in Ireland, for regular passenger and freight traffic, has been working since July 1888 without difficulty or accident. This line runs from Listowel to Ballybunion.

In 1901, Mr. Behr secured parliamentary powers to lay his mono-railroad track between Manchester and Liverpool. He was to run a ten minutes' service, and be able to carry sixty passengers at a speed not exceeding 110 miles per hour. The distance between Manchester and Liverpool is 34¼ miles. The journey was to be covered in twenty minutes. This line is not in operation on account of Mr. Behr being unable, at present, to raise sufficient funds to carry out the project.

The difficulties he has encountered have been innumerable. He has had to fight great railroad monopolies and vested interests, the companies believing that the mono-railroad would be a dangerous rival. It could in a manner, assist them. Utilized as an express, for instance, it would relieve ordinary and congested traffic. Time and expense would be economized in that shunting would be much relieved and reduced, as a uniform speed could be maintained. Shunting is, to a great extent, the cause of serious accidents. No less than 14,000,000 miles per annum of shunting is done by the Midland Railroad alone, and chiefly because of the various rates of speed in force.

Several eminent engineers look upon Mr. Behr's scheme as a type of the twentieth century railroad—a coming event casting its shadow before. It may be found not only running between Manchester and Liverpool. but covering even wider and wider areas in many civilized countries.

AN ENGLISH SUCTION GAS POWER PLANT.

A suction gas power plant consisting of three sets of 50 kw. each, has been running for more than two years in a machine shop in England. The engines are directly coupled to generators, and are governed by hit and miss gear, with an additional throttle governor on the gas inlet. The gas for the three engines is derived from a single suction producer plant. The fire is banked at week ends, and is put out for general overhaul at intervals of two months. A month's running showed a consumption of 22¼ tons of coke at a total cost of $65.27; 106,500 gallons of water costing $10.72; $81.50 for wages; oil to the extent of $8.04; sundries, $3.65; scrubber and purifier renewals, $1.34; interest and depreciation, $109.50; making a total of $280.02. The coke burned per horse-power hour was at an average of 2.22 pound. The total output during this time was about 22,450 horse-power hour, making the total cost of power 1.25 cents per unit, or about 1 2-3 cents per kilowatt hour, all expenses being included in the reckoning.

Reading is to the mind what exercise is to the body, as by the one health is preserved, strengthened, invigorated: by the other, virtue (which is the health of the mind) is kept alive, cherished, and confirmed.—Steele.

CATALOGUES AND CIRCULARS.

Six-Wheel Type Switching Locomotives.—The American Locomotive Company has just issued the ninth of their series of pamphlets covering the standard types of locomotives. As the title indicates, this number of the series is devoted to 6-wheel switching locomotives and contains halftone illustrations and the principal dimensions of 26 different designs, ranging in weight from 102,000 to 176,500 pounds.

Dust Prevention.—The Barrett Manufacturing Co., represented in Canada by the Paterson Manufacturing Co., Limited, Toronto, have published a report, made up from information received from the engineer of South Park Board of Commissioners, Chicago, regarding the cost and results of using Tarvia on macadam roads. Size, 3¼ x 8¼, pp. 16.

Electric Supplies.—The Canadian General Electric Company, Toronto, Catalogue No. 8 is descriptive of construction material and is of special interest to the electrical contractor and mechanic. Size, 8 x 10, pp. 556.

Switching Locomotives.—American Locomotive Co., New York. This catalogue deals with switching locomotives of the six-wheel type, with illustrations and particulars of the various type. Size, 6 x 9, pp. 60.

Locomotives.—American Locomotive Company, New York. This catalogue has to do with passenger locomotives of the eight-wheel type, with a full description of each. Size, 9 x 6, pp. 60.

Lighting Transformers.—In Bulletin No. 300 Allis-Chalmers-Bullock, Limited, describe and illustrate lighting transformers. A few of the noticeable features of these transformers are the low core loss, high efficiencies, low temperature rise, good regulation, and strong mechanical design.

Conveying Machinery.—Stephens-Adamson Manufacturing Company, Aurora, Ill. Number 5, Volume 3, of Conveying and Transmission contains valuable information for those interested in conveying machinery for all purposes. Size, 8 x 6, pp. 16.

Valves and Fire Hydrants.—Canada Foundry Company, Toronto. Bulletin No. 30 deals with valves and hydrants of various designs, and is of special interest to the waterworks engineer. Size, 11 x 8.

Storage Batteries.—Westinghouse Machine Co., Pittsburg. Catalogue S-2, No. 7008, deals with storage batteries for stationary service, with illustrations and particulars of the varieties manufactured. Size, 6 x 9, pp. 40.

Metallic Packing.—Caucos Manufacturing Co., Philadelphia. This pamphlet has to do with Black Squadron Metallic Packing. It is a combination sliding wedge, fibrous and metallic packing.

Contractors' Supplies.—Mussens Limited, Montreal. Bulletin No. 17 has to do with railway, mining and contractors' supplies. It contains information concerning hardy patent picks, mine hoists, wire rope and sheaves, rock drills, steam pumps, and other supplies of interest to the contractor.

Wooden Pipe.—The Dominion Wood Pipe Co., Limited, New Westminster, B. C., have sent us an interesting booklet descriptive of their wire wound wooden pipe. It is pointed out that there are many conditions under which wooden pipe may be used to greater advantage than pipe made of any other material. Size, 4½ x 6¾, pp. 30.

American Society of Mechanical Engineers.—The Indianapolis members of the society have published an artistically gotten up booklet, as a souvenir of the 1907 Convention, which will be held in that city. It contains a plan of the city, and a list of the places of interest. Illustrations are given of a number of the most important points, together with brief descriptions of each.

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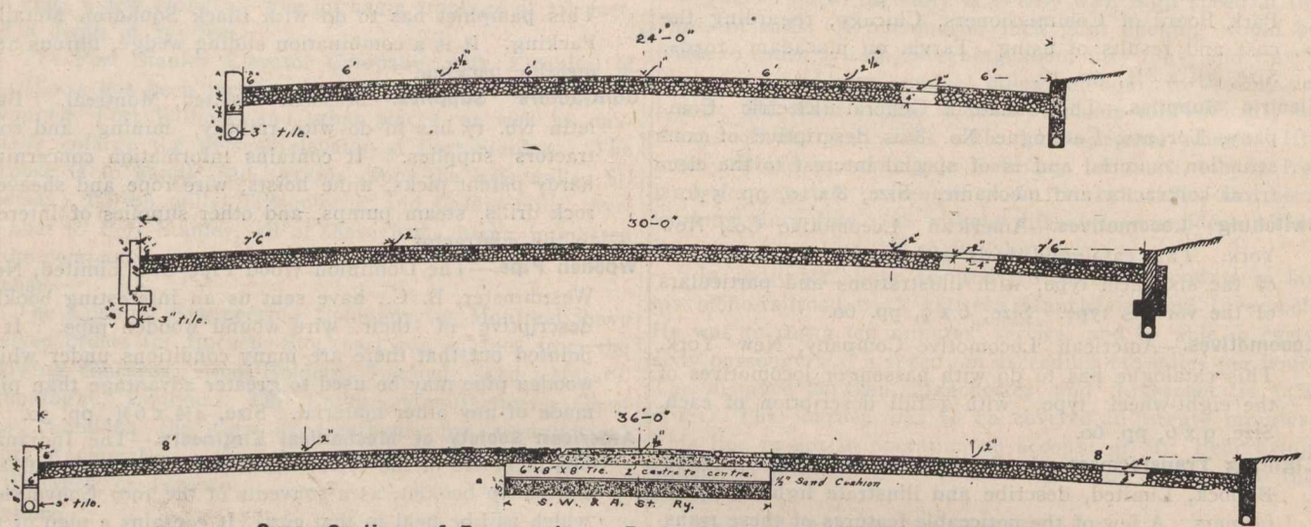
CONCRETE PAVEMENTS.

By Geo. S. Hanes, B.A., Sc., O.L.S.

Concrete pavements, as they are constructed in Windsor, Ont., are giving entire satisfaction.

They only cost 99c. per square yard complete including excavation, and are perhaps the cheapest pavement in existence for the high results obtained.

The pavements are clean, hard, smooth, and have an appearance similar to sheet asphalt pavements. Heavy loads of four and five tons are hauled without any difficulty. Horses can travel at a high rate of speed without falling and without even slipping, making far less noise than is the case when brick or block pavements are used. The pavement is sanitary in every respect, and an occasional flushing keeps it in perfect condition. Park Street and part of Chatham Street have been open for some time, and from present appearances no other kind of pavement will be constructed for some time. Altogether about 32,500 square yards will be completed this year. Chatham Street is located in the central portion of the city and is thirty feet in width. Park Street is thirty feet wide in the central portion of the city, and Wyandotte Street is thirty-six feet wide. As far as the writer can find out, these are the first important concrete pavements on main highways to be constructed in Canada.



Cross Sections of Pavements on Park, Chatham and Wyandotte Streets.

Windsor has about 78,000 square yards of Macadam pavements, which cost approximately $1 per square yard, also about 84,000 square yards of asphalt block, which averaged in cost about $2.50 per square yard, or $210,000.

The mud and dust on the Macadam roads has been very objectionable, and the writer asked the council to try some concrete pavements. The council granted permission, and since they seem to be so satisfactory and reasonable in cost the people do not wish any other kind. The specifications vary on different streets. Chatham Street specifications are as follows: Concrete foundation composed of concrete 1 : 3 : 6 (crushed stone ¼ to 3-inch). Wearing surface composed of concrete 1 : 2 : 4 (screened river gravel 1 to ¼-inch being used).

Church Street specifications: Concrete foundation 1 : 3 : 6 (crushed stone). Wearing surface consisting of two layers, one layer being concrete 1 : 2 : 4, and a top layer of concrete 1 : 2.

Wyandotte Street East specifications: Bottom or foundation layer consisting of concrete 1 : 2 : 4 (screened gravel), and a top layer of concrete 1 : 2.

Certain pieces of concrete which have come under the writer's observation, such as concrete crossings in streets and alleys where there is heavy traffic, have stood eight or ten years of hard usage without any appreciable signs of wear, and look now as if they would last for an indefinite length of time. Concrete pavements, if properly constructed, will do the same.

Windsor is situated in Essex County; a large portion of said county consists of blue clay of a very sticky nature.

The experience with Macadam pavements in Windsor is of a very serious nature. A city block of Macadam pavement, which was in good condition, was destroyed last spring in one day by the blue clay adhering to the wheels and in turn lifting the limestone dust and then the crushed stone and depositing it in other places; thus leaving the roadway in an almost impassable condition. The good roads scheme has been before the County Council for consideration.

Instead of laying an eight or ten feet strip of Macadam, which in this district would cost from $1 to $1.05 per square yard of 12 inches thick, the writer is of the opinion that if a strip of concrete be constructed for the same price, namely, $1 per square yard, then the problem would be solved so far as the blue clay districts are concerned, and the work when once completed would be of a permanent nature and would not be in need of constant repair. If it would not be advisable to have the concrete exposed in the country districts, one or two inches of dirt could be left on the surface. The writer believes this scheme would be worthy of consideration if permanent results are considered.

In a recent conversation with an engineer who has had a railroad experience extending over many years, the recent numerous railway accidents, and their causes were discussed. The engineer referred to expressed the opinion that many of the accidents are due solely to the negligence of the railway employes. If this is the case the penalty for negligence cannot be made too severe, especially when passenger trains are involved, an accident to which almost invariably means the loss of life. It is not the younger men that are careless, but those who have been railroading for some years, and having become very familiar with the work in which they are engaged, they think little or nothing of disobeying orders. "Familiarity Breeds Contempt." The result of this disobedience is only too well-known. It is not the intention to charge all accidents to the incompetence or negligence of those in charge, but we believe that if more care was exercised by trainmen, the number of accidents would be considerably lessened.

A Montreal by-law, recently passed, provides for the appointing by every theatre manager of a competent, experienced person, to be approved of by the chief of the fire brigade, and in the uniform of the department, and who shall be on duty at each theatre from one-half hour before to one-half hour after the time it is opened to the public. He shall see that all fire apparatus required by this by-law are in their proper places, in proper condition and ready for use. that all exits are unlocked while the theatre is opened to the public, and that all is in efficient and working order. He shall also require a drill of the theatre employees for the use of all apparatus and appliances for the prevention of fire inside of the building at least twice every week and report thereon to the chief