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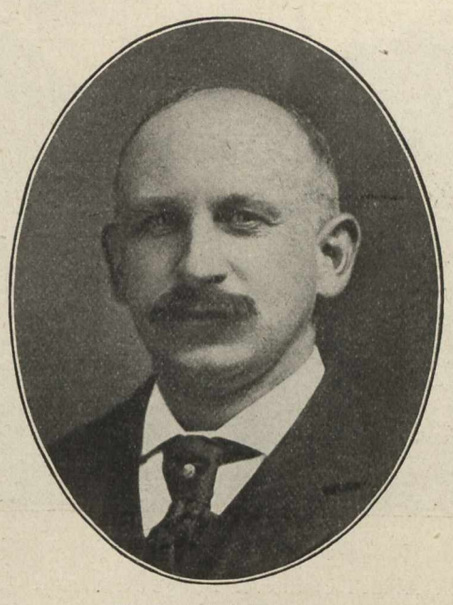
"We judge ourselves by what we feel capable of doing; but the world judges us by what we have already done."

Longfellow.



H. R. PLAYTNER.

At the Trades Congress held in Toronto recently a resolution was adopted affirming that Canada was moving too slowly in technical education; and only a few days ago the "Globe," of Toronto, came out with a trenchant article, setting forth the need of better accommodation, and a wider range of usefulness for the Toronto Technical High School. While artisans are declaiming in the halls, newspaper editors writing brilliant articles, and School Board directors looking into space, there is in the fair city of Toronto to-day a trade school which, for efficient teaching and practical usefulness, ranks with anything of its kind, either on this continent or in Europe, viz., the Canadian Horological Institute. New England is renowned for the skill of its workmen in the use of fine tools and the production of intricate and complex machinery. But at the competition instituted by the Faneuil Watch Tool Co., Boston, Mass., in 1897, the students of the Canadian Horological Institute carried off first, second and third prizes. In the official report of the judges—all Americans—is the following eulogy: "It is worthy of remark that all of the work of the prize winners is highly creditable, not only to the competitors, but also to the school which they attend." This trade school, with its band of earnest students, equipment of fine tools and instruments of precision, and practical methods of teaching, is the best object lesson in the Dominion of what a technical school should be like for the teaching of handicrafts as a substitute for the obsolete apprenticeship system of days gone by. It is a fitting thing, therefore, that in our portrait gallery of men who have "done things" in Canada the founder and maker of this institution should find a place.

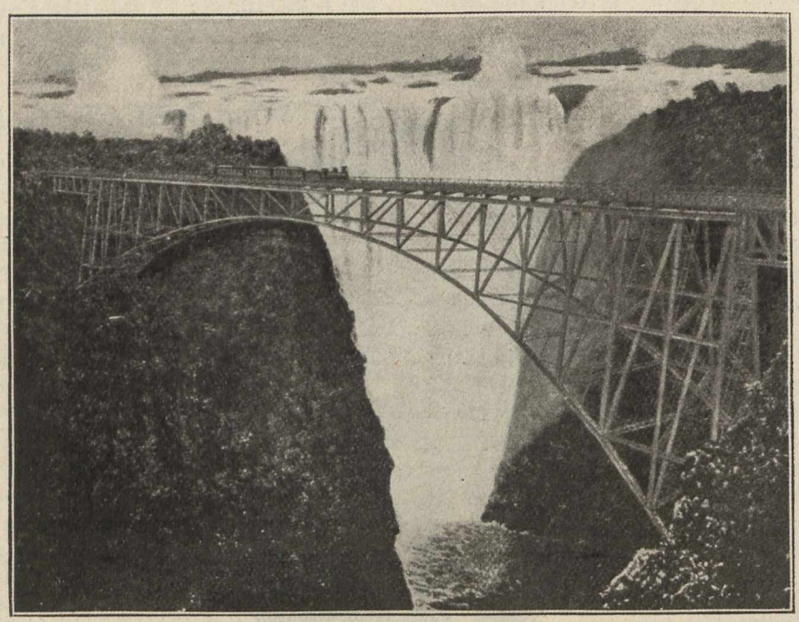
H. R. Playtner was born in Preston, Ontario, 1864. He received a common school education in his native town, and at the age of fifteen was apprenticed to the watch and jewelry trade under a man of sterling moral worth, and skilled in the art of the silversmith and the science of horology, viz., Mr. Edward Fox, of Kincardine, Ont. From the first he evinced earnestness and enthusiasm in his chosen vocation, thus complying with the Ruskin dictum that for a man to succeed in his work he must be happy in it. Romantic is the story of his early attempts to master the mechanics of a watch; how he found himself a mere copyist, owing to his defective eduction; how he forsook the pursuit of pleasure, and spent his holidays, evenings and early mornings in the study of geometry, mathematics, mechanical philosophy and drafting, and in the construction of models, mastering thoroughly the principles of the lever escapement, etc., thus laying deeply the foundations of that theoretical and practical knowledge which in after years he has applied so successfully in his school. After seven years he entered the employ of Kent Bros., Toronto. Here he was fortunate in meeting with Edward Beeton, a superior artizan of the "old school," who conceived the idea of a trade guild. In June, 1890, Beeton and Playtner opened a school with two pupils. At the end of two months Mr. Playtner was left in sole charge. Keen was the struggle to make it "go," and ere two years had elapsed would have undoubtedly collapsed had it not been for the timely financial aid of Mr. W. K. McNaught, now president of the Toronto Exhibition. After seven years of strenuous work the Institute was crowned with success, and is to-day an honor to Canada and a monument to the patience, perseverance and genius of H. R. Playtner.

STEEL ARCH BRIDGE ACROSS THE ZAMBESI RIVER, VICTORIA FALLS, RHODESIA, SOUTH AFRICA.

September 12, 1905, was a red letter day in the industrial history of the British Empire; for it was the occasion of the formal opening of the great arched cantilever bridge across the gorge of the Zambesi River, just below the famous Victoria Falls, South Africa, by Professor G. H. Darwin, president of the British Association for the Advancement of Science. Never did bridge, ship, railway, or canal, have such an august assemblage of the master minds of science to witness its baptism. Charles Darwin (father of the opener) wrote a book in 1871 on the "Descent of Man"; the noble steel structure (Fig. 2) built in sight of one of the sublimest scenes in nature—is one of the greatest engineering achievements in the "Ascent of Man"; and is a partial realization of the empire dream of Cecil Rhodes; for with its completion has been forged the most difficult link in the projected railway chain, to connect Cape Town with Cairo. A few years ago this region was a forest wilderness, with nothing to break the continuous thunder of the mighty water falls, but the roar of the tawny lion, scream of the golden eagle, or shot from the gun of the dark-skinned hunter. The genius of the engineer, however, has transformed it into a highway of commerce; opening out Afric's fertile lands and territories rich in mineral wealth, to the skill and industry of the surplus populations of the Old World.

The river above the Falls descends in a broad, shallow stream from the north, and drops suddenly 420 feet into a canyon nearly a mile long, and in places barely 100 feet wide, which stretches at right angles in front of the waterway. The fall takes place in four cataracts, separated by islands similar in formation to Green and Goat Islands at Niagara Falls. About 1,500 feet from the eastern end, the southern wall of the transverse chasm is broken through by a gorge 650 ft. wide at the top, and about 420 ft. deep—256 ft. deeper than Niagara Falls—supposed to be a fissure formed by an earthquake. The gorge zigzags southwards some twenty miles, and is the southern outlet of the Zambesi River. The new bridge crosses the gorge at a point about 700 yards below the cataract.

This bridge, erected thousands of miles away from the place of manufacture, is—apart from its romantic location—of special technical interest, since it is of purely British steel arch design. The general design of the bridge was worked out by Mr. G. A. Hobson, M. Inst., C.E., one of the consulting engineers to the Rhodesian Railway Company. "The conditions made an arch bridge of some form practically necessary, and the designer chose a two-hinged arch in preference to the three-hinged type because he considered that a more rigid, and consequently, a more durable bridge would be obtained by this choice."



From a Drawing by A. Elder in "River, Road, and Rail."

Fig. 1.—The Arched Cantilever Bridge Across the Zambesi River.

"In calculating the structure, the following loads were assumed in addition to the dead load: (1) A train of two engines followed by cars on each track; an average weight of 3,136 lbs. per foot of track; (2) stresses due to a variation of temperature of 60 deg. F., each way from mean temperature; (3) stresses due to a wind pressure of 30 lbs. per square ft. on train and bridge, or 45 lbs. per square ft. on bridge alone; calculated on entire area of both arch trusses with allowance for unequal distribution of pressure. The stresses were calculated by the method described by Prof. Clerk-Maxwell in the 'Encyclopedia Britannica.' A feature that had to be kept in mind generally in the designing and estimating of the structural parts, was, that they had to be taken across the gorge by means of a cableway, the maximum weight load on which was to be ten long tons." The following is a brief general description of the bridge: referring our readers to the sources indicated in the footnote to this article for more elaborate details.

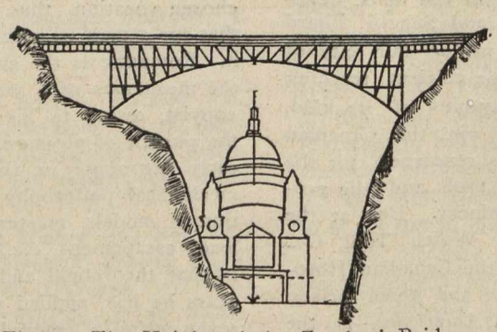


Fig. 2.—The Height of the Zambesi Bridge, as Compared with that of St. Paul's Cathedral.

The principal feature of the bridge—which has a total length of 650 ft.—is the main span, 500 ft. from centre to centre of bearing pins, consisting of a two-hinged spandrel braced arch, of true parabolic curve; and flanked at both ends by short truss spans, 87'-6" and 52'-6" long respec-

tively. The rise of the main arch at crown is 90 ft., the depth being 15 ft. at centre, and 105 ft. at bearings. The total height from rail level to water level in the dry season being roughly 420 ft.; the level in wet season being, say 40 ft. less, or 380 feet. This measurement will make the Zambesi bridge the highest in the world; the nearest to it being the Viaduct du Viaur in France (recently finished), which is 375 feet above the bottom of the valley it crosses. The ends of the arched trusses rest on steel skewbacks resting on concrete pedestals. It is estimated that the thrust on each foundation rock will be 1,600 long tons. The width at the springing of the arch is 53'-9" between the centres of booms; at the top 27'-6"; and between parapets 30 feet. There are two lines of rails, although the existing railway track from Cape Town to the bridge is only a single line of 3'-6" gauge. But a width sufficient for a double line across the bridge was necessary, in order to provide for lateral stability. Acid open-hearth steel was employed throughout: classified as "rolled steel" and "rivet steel." The rolled steel was required to contain not more than 0.06 per cent. phosphorus, and be capable of sustaining an ultimate tensile stress of 67,000 lbs., rivet steel 58,240 to 67,200 lbs. per square inch U. T. S. Holes drilled throughout, and machine rivetting wherever practicable. The total weight of steel in the bridge is 1,650 tons, and the approximate cost —including erection—was £70,000. North of the Falls, 170 miles of line have already been constructed, and the laying of the track is proceeding at a pace so remarkable that during the twelve working hours of September 27th, 5¾ miles of track were laid—said to be a world's record.

The planning of the bridge was carried out by the Rhodesian Railway Company, under the supervision of, and in accordance with, the specifications of the company's engineers: Sir Douglas Fox, M. Inst. C.E., Hon. M. AM. Soc. C.E., and Partners; Sir Charles Metcalfe, Bart., M. Inst., C.E., and Mr. G. A. Hobson, M. Inst, C. E., who were represented on the spot by Mr. Townsend, Mr. Tower, and Mr. C. Beresford Fox. The contractors were the Cleveland Bridge and Engineering Company, Darlington, England. The method of erection of the arch span was devised by Mr. A. C. Imbault, in charge for the contractors.

"The line reached the Zambesi and its wonderful falls on April 25, 1904. The engineers began operations by firing across the gorge a rocket, to which a fine string was attached. After three attempts they succeeded, and by means of the string were able to pull a cord across, then a wire, and eventually a ⅝-inch diameter steel wire rope 900 ft. long, the cable being supported at each end by a solid post 2 ft. in diameter, let down into the rock some 7 or 8 feet. When strained tight by means of a running pulley, and a "bosun's chair"—a piece of wood suspended by four ropes, with a canvas back and a sack and board as foot-rest—persons were able to get across, Mr. Beresford Fox being the first to make the hazardous journey through the air."

From Mr. Francis Fox's "River, Road, and Rail."

Fig. 3.—The Gorge of the River Zambesi, Victoria Falls. Mr. C. Beresford Fox crossing the Gorge for the first time on the wire rope, Nov., 1903.

The British South African Company—which owns the land on both sides of the cataract—is arranging to reserve a large area of the forest extending for some six miles on each side of the river in the vicinity of the Victoria Falls, as a public park, to be preserved forever in its natural beauty.

When the Cape to Cairo route of 6,000 miles—4,000 rail, 2,000 water—is completed, it will be the most remarkable trans-continental railway system on the globe; and this half-way stopping place at the Zambesi River, in sight of the Victoria Falls—which ranks in grandeur with the New Zealand geysers; Canadian Horseshoe Falls, and Alps; Kyber Pass and Himalayas of India—will make available to the traveller another scenic wonder within the bounds of the British Empire. The Engineer has made this possible.

[For the technical data in this description, we are indebted to "Engineering," London, July 7th and 21st, 1905; "Engineering News," New York, October 5th, 1905; "Public Works," London, October-December, 1905; Mr. Francis Fox's "River, Road and Rail," published by John Murray, London, and other sources.]

SYSTEM IN INDUSTRIAL ESTABLISHMENTS

BY A. J. LAVOIE.

THE ORDER: CONTINUED.

If there are none of the specified articles in stock, then fill in card form No. 34 and 35, immediately after the proper requisition has been made, and enter the requisition number on this card (as already specified, the minimum and maximum is to be determined by the engineer in charge of the job); also enter the requisition number on part list form No. 96. After checking form No. 96, you will have exact knowledge of what articles are in stock—rough or finished, and what have to be made in the works or bought outside, and moreover, know on what sheet it is ordered, together with the date, hour and minute the General Store Requisition was sent to department No. 2, etc. Forms No. 26 and 27 are made in triplicate; the original and duplicate being sent to department No. 2 for approval, and from thence transferred to production office in department No. 4. The triplicate form is sent to the receiving office to be used also by the inspector and is placed on file therein, in numerical order, (1) to serve as a record of the requisition; (2) to apprise the receiving office that the lacking articles have been ordered; and (3) to call the attention of the inspector to the fact that certain articles not in stock have been duly ordered by formal requisition. Upon receiving the duplicate form from the production office—having similar marks to those made on the original—the inspector is able to verify and check his triplicate copy, and is thus in a position to notify department No. 3 of any change that may have been made before it reached him—the inspector. In this way avoiding trouble when assembling machines, i. e., discovering that some parts have been cancelled, while others have been incompletely ordered. As a precautionary measure, the triplicate forms are first filed separately in numerical order, until the duplicate corresponding to the triplicate is received from the production office. If the duplicate is not received at time promised, within an hour or day at most, a "hustler sheet" must be sent straightway to the production office. If this part of the system is carried out with promptitude then there can be no excuse if the work is not ordered in time. When the duplicates are delivered to the receiving office, having been approved by the inspectors, it may be discovered that important changes have been made thereon, if so, see to it that the stores record card is made to correspond at once. Then file away your duplicate, in consecutive order, on a separate file. This done, remove the triplicate from its file and transfer same to the cost department, to be placed next to the original, until the duplicate arrives to divide them.

Now coming back to the original and the duplicate, after they have been made by the general store, sent to department No. 1, then on to department No. 4, what becomes of them? Let us see.

The original and the duplicate forms No. 26 and 27 after being prepared in the store offices, are sent to department No. 2 and approved, then transferred to production office in department No. 4.

A. J. LAVOIE'S SYSTEM No. 28 — PRODUCTION DEPARTMENT

FOREIGN SHIPPER PLEASE NOTE

I will not pay for boxing or packing

Send all invoices in duplicate, and state terms on each invoice. The original of foreign invoices must be certified for use at customs. Please send invoices with bill of lading on the same day goods are shipped. All communication relating to Purchasing Order, or invoices must be addressed to the Purchasing Office, P.O. Box 46, Longueuil, P.Q., Canada.

I will not be responsible for any goods delivered without Purchasing Order. Kindly enclose packing slip in each package, number each package, and put this number on invoices.

DATE ..... 190..... TO MR. .....

ADDRESS .....

*PURCHASING ORDER No. .....

THIS NUMBER MUST BE PUT ON ALL CORRESPONDENCE AND INVOICES, OTHERWISE THEY WILL BE RETURNED.

PLEASE SHIP TO **A. J. LAVOIE'S SYSTEM,** LONGUEUIL, P.Q., CANADA

VIA, ... STATE TERMS AND DATE SHIPMENT WILL BE MADE

This Purchasing Order is issued to fill General Store Requisition No. .....

And Job No. .....

The above two numbers are no good to outsiders.

A. J. LAVOIE'S SYSTEM

..... Purchasing Agent

Printed Blue on Bond or Linen Paper (Pink Paper), padded at top only, in the following arrangement, 1st sheet to be of 20 lb. paper, 2nd sheet to be of 20 lb. paper, 3rd sheet to be of 80 to 100 lb. paper or light board. Each sheet to bear the same number, from last number furnished. *Numbered in triplicate as mentioned above.

If articles are to be purchased, both original and duplicate forms, No. 26, should be given to the purchasing office, so that the articles can be ordered immediately on triplicate form No. 28.

The purchasing agent should not forget to scrutinize his index cards in order to see if any special prices, or delivery dates were asked for on the articles in question. This is very important, because the market prices of the goods may have increased since the date of quotation. This is important, especially if large quantities are needed. On the other hand, if the prices are lower, this advantage should not be missed.

A reserve stock may have been kept in hand by the dealers, awaiting your answer about the particular contract.

It is good business practice to immediately notify the dealers, if your tender has been rejected by the customer. Thus giving him a chance to dispose of his stock to advantage in some other quarter. There is still room for the

"Golden Rule" in the business ethics of the twentieth century.

In ordering, each article must have separate purchasing order, the originals being sent to the dealers with all the necessary remarks. The duplicate of form No. 28 to be the following day. If it comes later a report should be demanded, explaining the cause of delay. These originals on file should be kept there, until the arrival of triplicate form No. 26. But as soon as the latter is received, transfer both forms to another file, placing them in consecutive order

A. J. LAVOIE'S SYSTEM No. 29 — PRODUCTION DEPARTMENT

PRODUCTION OFFICE REQUISITION

Approved by Production Engineer ● Approved by Shop Foreman ●

A. J. LAVOIE'S SYSTEM, LONGUEUIL, P.Q., CANADA

NAME OF SHOP

To ..... Date ..... 190..., Prepared by ..... Clerk

Please supply the STORES with the following ARTICLES, ROUGH and FINISHED

NAME OF ..... Dep't, Do not Order Date ..... 190...

Anything before it is APPROVED BY ..... Superintendent

PRODUCTION LIST No. .....

Numbers of Pieces Required	Name and Description of Articles	Drawing No.	Pattern No.	Material	Weight of One	Check Ordering	Check Compl't'd	General Store Requisition No.	Job No.

Printed Blue on "Pink" Bond or Linen Paper, 20 lbs. Padded on top only.

attached to duplicate of form No. 26, and when completed to be sent to the receiving office to enable them to check off goods approved by the inspector. The triplicate of form No. 28 to be attached to the original form No. 26, and sent to the cost office, thus advising them that certain goods are

according to purchasing order No.; until the duplicate forms No. 26 and 28 are returned from the receiving office, then file away separately for record under general store requisition Nos.; and purchasing order Nos.: all placed in consecutive order. Note that all foreign invoices and remarks

DRAWING No. | NAME OF ARTICLE | MATERIAL

PATTERN No. | TYPE OF MACHINE | WEIGHT OF ONE | MINIMUM | MAXIMUM

IN BUILDING No. | ON FLAT No. | IN RACK No. | ON SHELF No.

INVENTORY		ORDERED			RECEIVED				BALANCE ON HAND
DATE	QUANTITY	REQUISITION No.	DATE	QUANTITY	REQUISITION No.	JOB No.	DATE	QUANTITY	

A. J. Lavoie's System. Dept. No. 4. Form No. 34. Stock Record Card.

ISSUED ON REQUISITION			WORKMAN CHECK No.	BALANCE IN STOCK
JOB No.	DATE	QUANTITY		

Form No. 35 Back of Stock Record Card.

Form No. 34-35 to be printed blue on 100 lbs. pink light board,

coming, and that they are to expect invoices of same. The cost office should keep the original forms together on separate file in consecutive order until the reception of triplicate form No. 26 from the receiving office; which must be in the hands of the cost office index clerk not later than

must be attached to their own purchasing order. If you have several articles with different requisition numbers on one invoice, attach a memorandum to the respective purchasing orders, indicating the requisition order No., to which the invoice is attached. Do likewise with any quotation

sheets from dealers; in this way you will avoid waste of time and trouble. One card index must be kept in the purchasing office giving full particulars of all purchased articles or quotations, also full instructions so that they can be located instantly no matter where they are. (See purchasing office: its appliances, forms required, and instructions for handling same—to be published later.).

Let us now consider form No. 27, which is to be used when articles are to be manufactured in your own establishment.

In a previous chapter we have dealt with the making of form No. 27, traced its travel until it reaches the production office in department No. 4. The duty of this department is to consider the nature of each respective article and determine in which section of works it can suitably be made, then issue order at once to the department interested. This order is made as follows: Prepare form No. 29 and send the last copy to the cost office as a warrant, or record, etc. The original goes to the general store receiving office, for inspecting and receiving purposes. This original form must be returned to cost office as soon as all the articles indicated thereon have been inspected and received by the general store, care being taken to attach inspector's report to each original form No. 27. Upon reception of the original form No. 27, with inspector's report attached, the cost office will immediately remove the copy they have already on file, and place it next the original in its own file, awaiting the arrival of other copies. At this stage, the reader naturally asks the question, how many other copies are there? What are they for?

(Continued.)

MANUFACTURE OF BROAD FLANGE STEEL BEAMS

The rolling mill, and endless variety of steel shapes or "sections" made thereon, are familiar subjects to all interested in the great industries of iron and steel.

It will suffice, therefore, to say, that the rolling mill as it has existed from the middle of the last century to the present day, consists essentially of two parallel rolls driven in opposite directions in such manner as to draw the piece of hot metal through, and reduce it to the required "section."

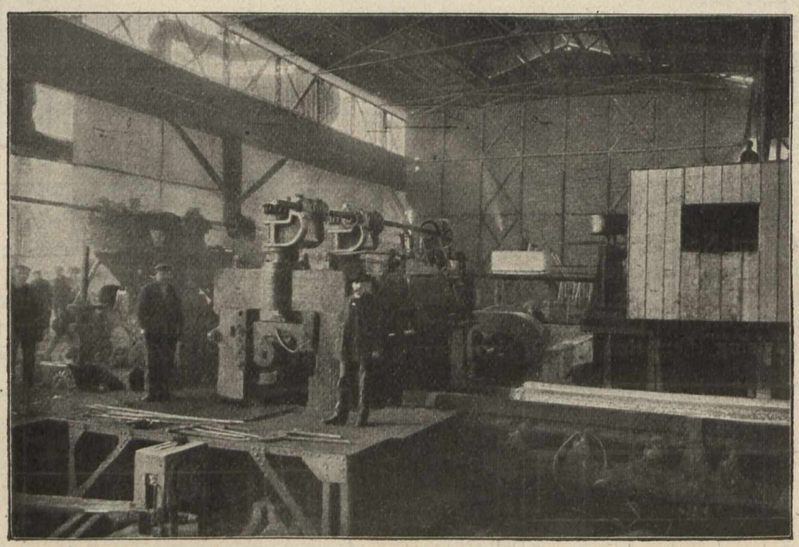


Fig. 1.—"Grey" Mill: Metal Entering Rolls.

Although various innovations have been made from time to time in the driving machinery, operating mechanism, and form of housings, the rolling mill in its general design and mechanical principles has changed very little; at any rate so far as the production of rolled steel girders is concerned.

The ordinary rolled steel joist of commerce was designed as a bar of metal possessing a maximum carrying power (used longitudinally or transversely with a minimum weight of material. In its conception the shape is an ideal one, and its universal excellence can only be qualified by two limitations:—(1) That the dimensions of rolled steel girders produced by ordinary means are strictly limited with regard to the height and width of the sections. (2) That the system of forming the flanges by pressure of the metal into grooves in the rolls, whilst being adequate for the small light sections, leaves something to be desired where a thoroughly sound beam of substantial dimensions is required.

The necessity for large sections, both as girders and struts, has, of course, been met by the use of "compound" sections composed of beams and plates, plates and angles, and various other combinations.

All these have their uses, but nevertheless a great gap remained for a long time unfilled. This was the obvious necessity for a rolled steel girder, with liberal limits as to height and width, and carrying power in comparison to weight in excess of anything previously obtained.

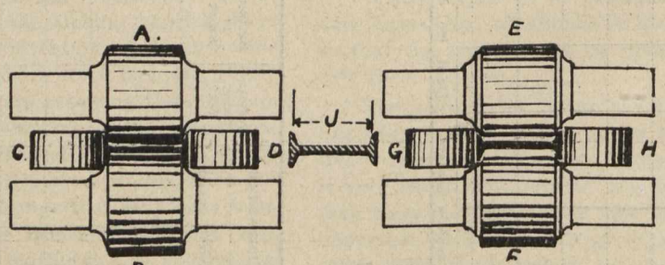


Fig. 2.—"Grey" Mill: Arrangement of Rolls.

Ordinary rolling mills and conventional methods are altogether unequal to the manufacture of such sections. Their extreme limit as regards flange width, viz., eight inches, being in itself an insurmountable barrier to the production of anything adequate from an ordinary mill.

Hence, the "Grey" universal mill was designed, to pro-

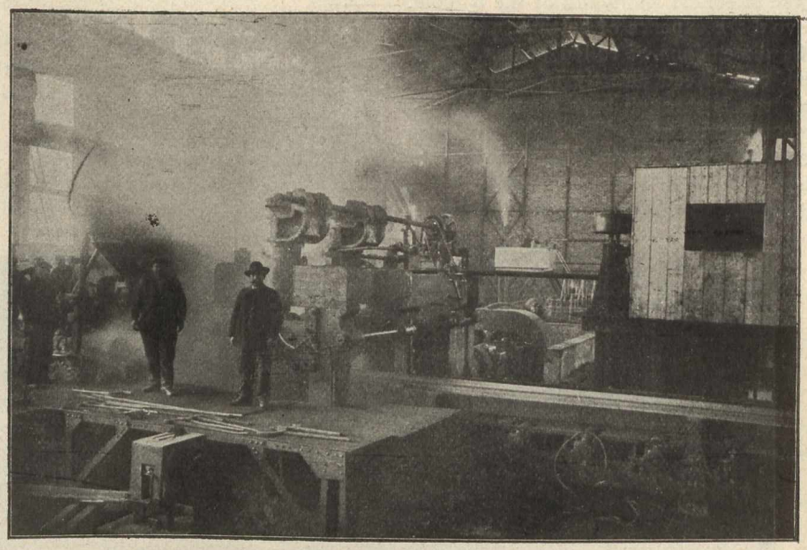


Fig. 3.—Beam Passing Through Rolls.

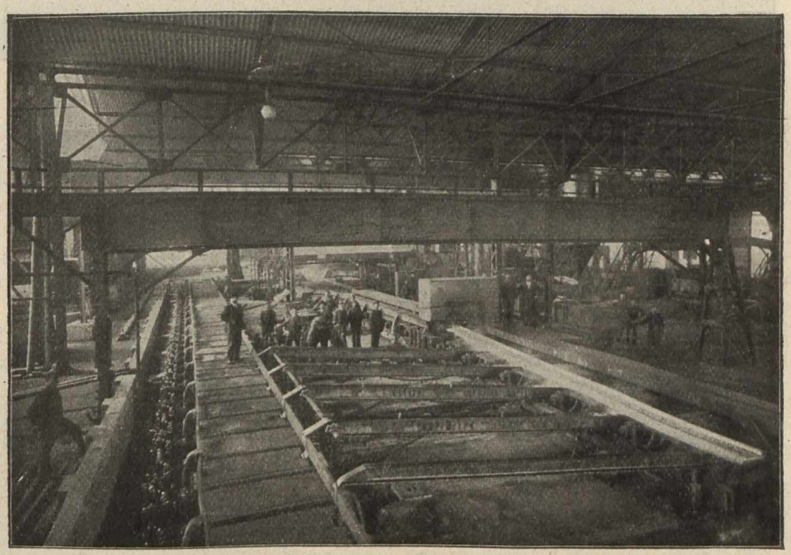


Fig. 4.—Sawing a Hot Beam.

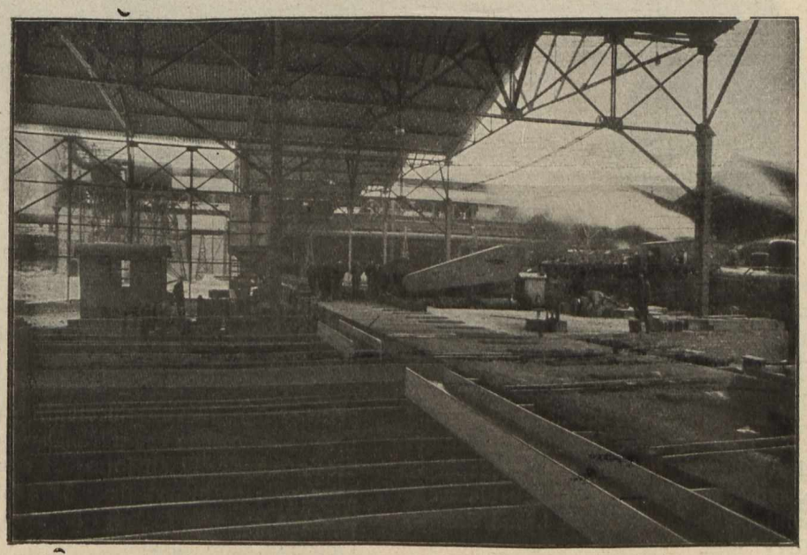


Fig. 5.—Beams on Hot Bed, Showing Saw.

duce from one set of rolls, girders which vary in the thickness of the web and in the thickness and width of the flanges; the intention being to avoid the expense of cutting fresh rolls to suit variations in the dimensions of rolled beams. Two stands of rolls are used, one placed directly in front of the other so that the girder travels through both stands of rolls at every pass, as in a continuous mill. Each housing also carries a pair of vertical rolls between the necks of the horizontal rolls, the axes of all four rolls in housings being situated in one vertical plant. In the first stand (Fig. 3) the

The series of "broad flange beams" has a considerable range of sizes, extending from 7" to 30" in height, and as regards flange width, all the sections up to 12" high are "square," that is the flange width is equal to the height. The sections over 12" high have a uniform flange width of 12".

The practical advantages of broad flange beams have been rapidly recognized by engineers and architects of eminence in all parts of the world. The smaller sections,

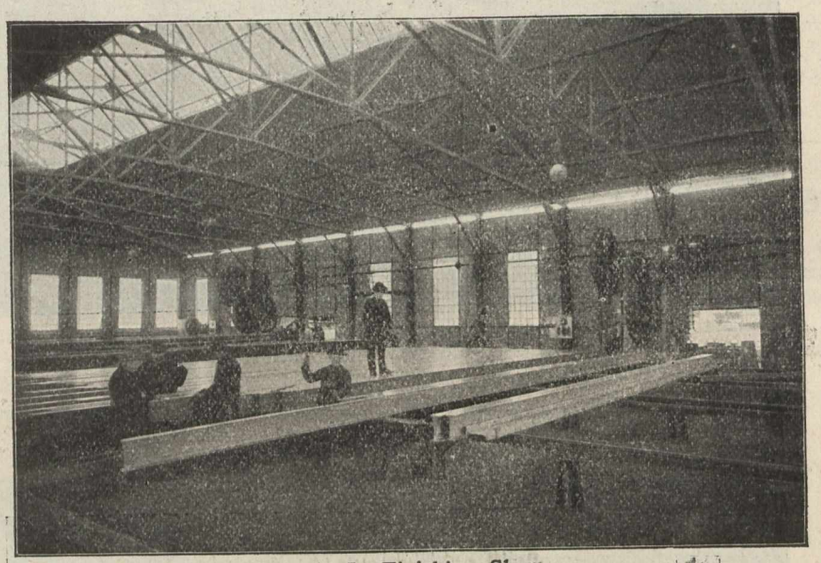


Fig. 6.—In Finishing Shop.

web of the girder is pressed between the horizontal rolls A, B, which determine its thickness; and the flanges between the ends of the rolls, A, B, and the faces of the vertical rolls, C, D, which determine their thickness; but leave them free to spread to any width: this width being determined by the rolls E, F, in the second stand, which do not touch the web, but act only on the edges of the flanges, which are held in position, and are prevented from thickening or turning over by the rolls, G. H. Thus the only dimension which is invariable, is the distance J. The width of flange, its thickness, and the thickness of the web are all variable at will, within considerable limits.

This mill can turn out girders with flanges wider and thinner than any which it is practicable to make in rolls of the usual construction.

The arrangement of the guides, the methods of driving the vertical rolls, and for securing simultaneous adjustment and working of all the rolls in unison, are exceedingly ingenious and effective, and account for the remarkable evenness of section and definition in form of the broad flanged beams made on the "Grey" mill.

on account of their extremely logical design, are an improvement on any form of stanchion obtainable. Due to the process of rolling referred to, they possess an immense carrying power in proportion to weight.

One very acceptable feature of these sections which commends them to designers of structural steelwork, is the large area of flange which is available for drilling to make bolted or other connections.

The larger sections are used for practically all purposes for which compound girders have hitherto been employed.

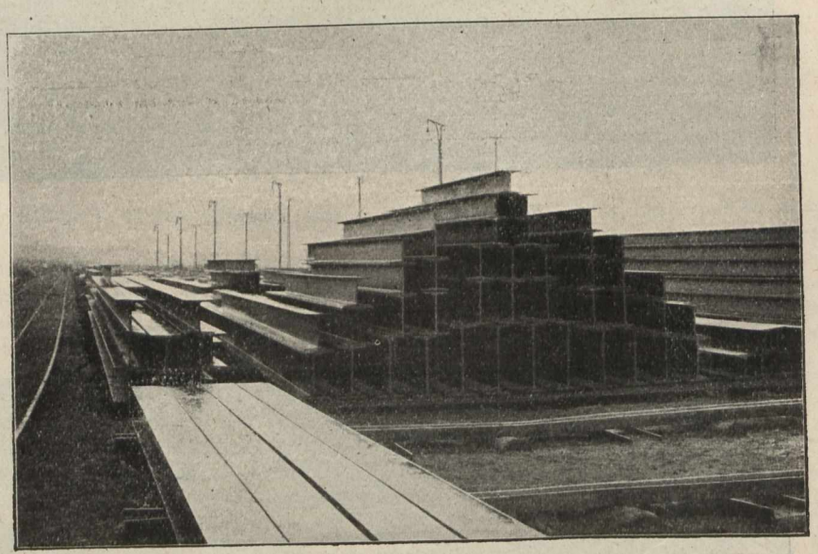


Fig. 7.—Beams in Stock Yard.

In bridge work they have proved particularly advantageous, effecting considerable saving in weight, and, of course, dispensing with all the riveting which is necessary in the construction of compound girders.

It may be added, as a tribute to the sagacity and enterprise of Canadian Engineers, that they have been among the first to recognize the advantages of broad flange beams for use in practically all forms of constructional steelwork, and already large orders have been placed by Canadian buyers through Watson Jack & Company, of Montreal, who are the Canadian sales agents.

THE "DAILEY" ROTARY STEAM ENGINE

The archives of the Patent Offices of all lands show more claims for patent rights on rotary engines than almost any other type of mechanical appliance. Fortunes have been spent and lost in the attempt to develop the rotary principle in steam engines. A small fortune was spent by George Westinghouse in the early days of his Company in the endeavor to perfect a rotary engine. There is hardly a name famous in the annals of Engineering, but has been at some time or other, associated with the struggle to wrest from Nature the secret of her physical laws according to which the rotary principle can be applied economically. Up to date the pursuit has been as fruitless as the search for perpetual motion, or the philosopher's stone. The failure in most cases has been due to the fact that the rotary principle has not been carried out logically; the counterbalancing principle of reciprocation has invariably been introduced into the mechanism, hence the failures of the past. We deem ourselves fortunate in being able to introduce to our readers an engraving of the first photograph taken of the 4 H.P. "Dailey" rotary engine recently developed at Galt, Ont.,—after 10 years of costly experimentation—by Mr. Charles Hetherington, who is pictured in conversation over the miniature engine, with Mr. Wellington Roelofson, an intelligent young Engineer, responsible for many of the improvements made in the mechanical details of the engine, which has brought it to the stage of probable commercial success.

As far as our knowledge goes, this engine is the most complete and logical embodiment of the rotary principle—as applied to the steam engine—in existence; for there is not a reciprocating part in it. As we stood in the machine shop of R. McDougall Co., Ltd., Galt—where the 4 H.P. engine illustrated has been built, and witnessed it—without load—making 940 revolutions per minute, with 4½ lbs. steam, we were favorably impressed with its lines of beauty, simplicity of construction, and almost noiseless operation. The whole engine weighs only 150 pounds and stands 16" high. The promoters claim, that upon being attached to a dynamo, it developed energy to run 40-16 C. P. lights, 110 volts at 65 pounds steam, and 1,100 revolutions per minute. Before committing ourselves to any positive affirmation with regard to the efficiency and commercial value of this unique invention, we must—as a matter of course—have before us evidence based upon scientific tests, made with an engine of greater capacity, say=25 H. P., giving brake H.P., steam consumption, and time record as to wear and tear of parts; but on sight, we have to congratulate Mr. Hetherington upon the measure of success which has crowned his patience and perseverance so far. We think he is on the right lines, and are of opinion that his engine has passed the toy stage, and is worthy of serious investigation by responsible Engineers. The main constructional feature of the engine is its *simplicity*: the secret of all true Engineering. It consists essentially of three working parts: A rotor, in which is contained the pistons, and a duplicate pair of balanced abutments. (1) It is its own steam chest. (2) automatically its own cut-off—at any part of the stroke; (3) is reversible; (4) takes steam twice at every revolution; since it has four pistons. (5) In a 4 H.P. Engine the heaviest working parts—the rotor, weight 43 lbs., while the abutments weigh only 5 lbs. each.

A NOVEL WATER HOIST

The question of clearing a mine of water is always a serious problem to the mine manager; especially so when the water is highly impregnated with acids. When the amount becomes excessive, the means to be employed for its elimination taxes to the uttermost the ingenuity of all concerned.

In the anthracite regions there are mines in which for every ton of coal raised, as much as 14 tons of water must be pumped, at a minimum cost. A great variety of pumps and lifting devices have been tried, but the most satisfactory type up-to-date for handling large quantities of water at comparatively low heads, is the large bailer, operated by steam. This device, however, lacks the mechanical regularity inherent in a pump, since it is necessarily operated by hand. It remained for the Delaware, Lackawanna & Western R. R. Company, and its electrical engineer, Mr. H. M. Warren, to finally develop a water-hoisting equipment which, while preserving all the valuable points of the steam hoist, would at the same time, operate automatically. The carrying out of the mechanical details of this new type of hoist and its automatic attachments was confided to the Wellman-Seaver-Morgan Company, of Cleveland, Ohio, and the successful operation of the plant reflects great credit on the latter, as they guaranteed the machinery to accomplish the desired results. Most of the electrical controlling devices were furnished by the Electric Controller & Supply Company, Cleveland, O. In the original specifications the Delaware, Lackawanna & Western R. R. Company called for the hoist to be operated by an alternating current motor of 800 horse-power, and the question of starting, stopping and reversing so large a motor had, at the outset, to be met. The duty to be performed by the hoist called for the raising of 4,000 gallons of water per minute to a height of 550 feet.

4,000 gallons × 8.27 = 33,180 lbs.
550 ft. 2-inch rope × 6.3 = 3,465

36,645 lbs. to be raised 550 ft. per min.

$$\frac{36{,}645 \times 550}{33{,}000} = 610 \text{ net horse-power.}$$

Weight of bucket = ½ weight of water, so that weight on rope = 53,235 lbs. or nearly 27 tons, requiring 2-inch steel rope.

The various preliminary speed and movement diagrams are laid out per accompanying diagram.

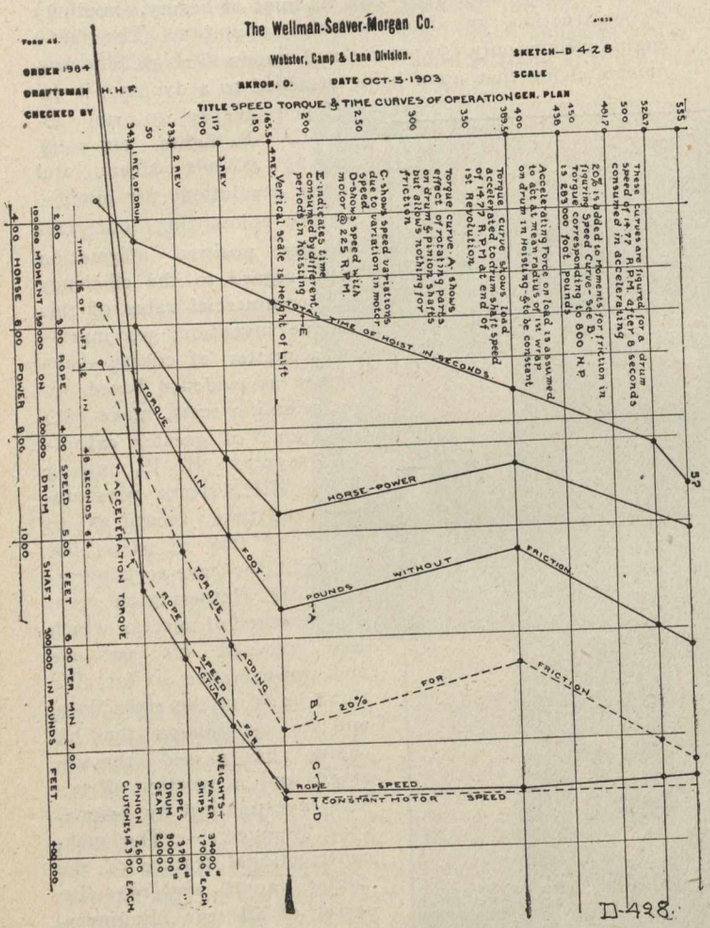


Diagram.

It was decided in carrying out the design that it would be impracticable to operate the hoist unless it was provided with a motor running continuously in one direction; since it is a well-known fact that the amount of electric energy required to accelerate a large motor of this type is enormous, and greatly interferes with the proper running of the power plant.

The Delaware, Lackawanna & Western R. R. Company desired to use an A. C. Motor directly at the hoist, and as the motor was to run continuously in one direction, this necessitated the use of friction clutches for accelerating and reversing the load. As the Wellman-Seaver-Morgan Company had several smaller plants already in operation using A. C. motors on hoists which are operated similarly to the one in review; and as they are running successfully, and the repairs and renewals for clutches had not exceeded that required for the other hoisting engines, it was decided to adopt this method.

Figs. 1 and 2 show a front and side view of the hoist. As will be noticed, the general arrangement consists of a motor driving a pair of bevel gears through a single bevel pinion. The bevel gears run loose on a shaft, and are fitted with the well-known Webster, Camp & Lane friction clutches. The operating mechanism for the clutches are so designed that only one clutch can be thrown in at a time; but both clutches can be out at the same time. Throwing in one clutch drives the drum in one direction; throwing in the other clutch reverses the motion of the drum.

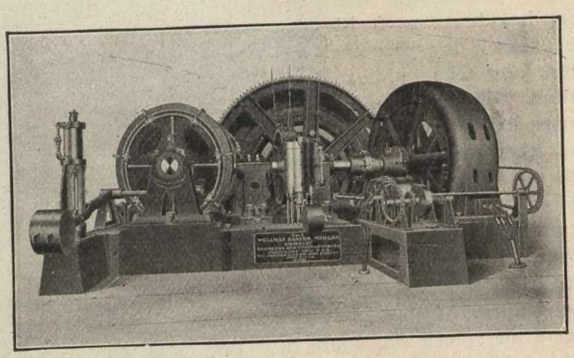


Fig. 2.

To the shaft on which the bevel gears run, is keyed a pinion, meshing with main gear on the drum shaft. The drums are of the cylinder-conical type, to 10 ft. at the small diameter and 16 ft. at the large diameter. At a hoisting speed of 550 ft. per minute, the drum makes about 15 RPM. There is one main brake located between the drums. All of the clutches and brakes are operated by auxiliary air cylinders, fitted with oil cushion cylinders; the compressed air being furnished by a motor driven compressor, and necessary tanks located near the hoist. The hoist is controlled by a mechanical device, shown in Fig. 2. This device consists mainly of a drum rotated by means of a friction drive from the motor through a sprocket chain. The drum shaft transmits its motion to a secondary shaft fitted with a variable speed device, which in turn operates a secondary stop. The main hoisting drum shaft operates a travelling nut which is so located with respect to the controller drum that at either end of its travel it releases a stop and allows the controller drum to make a quarter turn; this movement, through suitable electrical connections, operates the

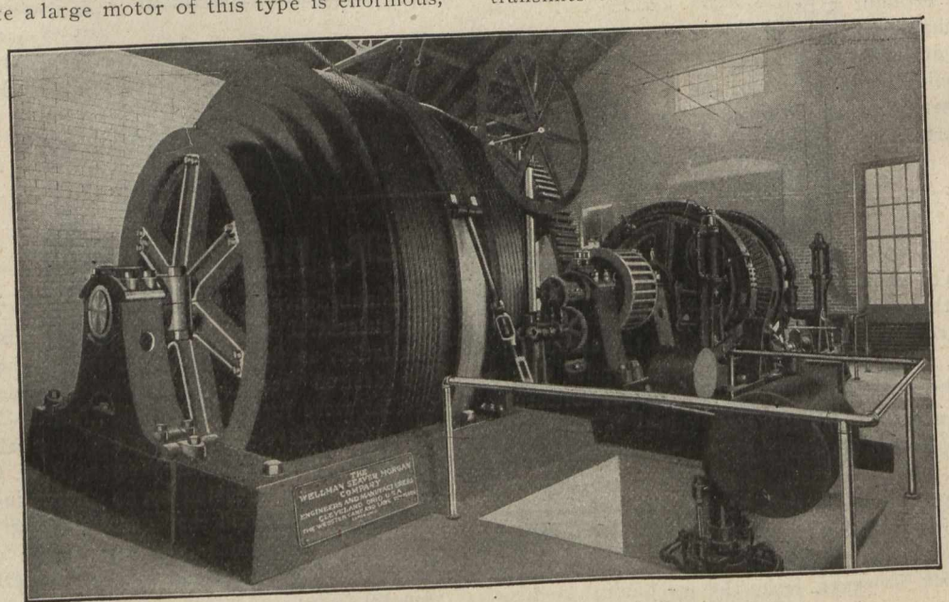


Fig. 1.

solenoid on the clutch valve, releasing the clutch and the solenoid on the brake valve setting the brake, the further movement of the controlling drum being arrested by the secondary stop. This stop is released by the variable speed shaft and its connections, which has been given a predetermined time movement corresponding to the interval for emptying the bucket. The further movement of the controlling drum releases the brake and throws in the reversing clutch, thus starting the hoist in the opposite direction, and also starting the traveling nut on the controlling mechanism in the opposite direction. At the end of the hoist the cycle of controlling movements is repeated and so on, making

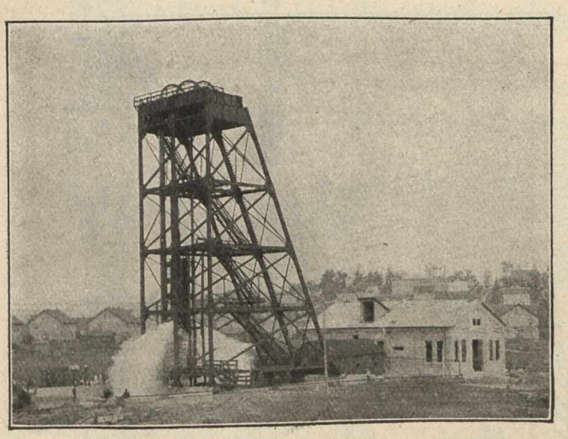


Fig. 3.

the hoisting operation continuous and automatic. Every attention has been given to the safe operation of the hoist. The main brake is of the gravity type, and to be released, the current must be on the solenoid operating the valve, so that air can be admitted to the underside of the brake. If for any reason, either the supply of current or of air pressure is interrupted, the valve drops, and the weights on brake lever set the brake. The clutches are designed so that they are thrown out by weights. As is the case with the brake, either clutch can only be thrown in when the current is on the solenoid, and the air pressure admitted under the piston, and if either current or pressure fail, the

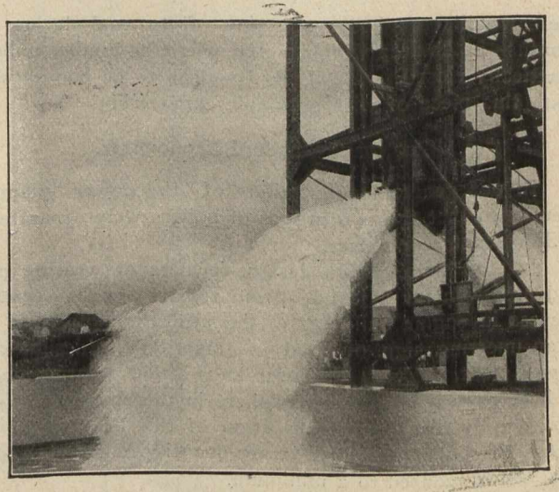


Fig. 4.

clutch is off. The motor shaft is fitted with an emergency brake operated by a weight controlled by a solenoid, hence any interruption in the flow of current to the motor sets the brake and stops the motor. Any interruption of the flow of the current stops the machine, throws out the clutches and puts on the brake. A safety cut-out is provided for in the head frame, so that in case a bucket is carried beyond the proper height the current is shut off.

Fig. 3 shows the head frame, which is 93 ft. from base to centre of the sheave at top. It is built of structural steel, roughly in the shape of an "A." From the head frame are suspended two buckets 6 ft. in diameter and 19 ft. 6 inches deep. The capacity of each bucket is 17 tons of water. In the bottom of the bucket are located two lift gates with an area practically equal to the cross section of the bucket. These gates are lifted automatically when the bucket reaches the top, and the water is discharged through the bottom into a spout fitted below the bucket, which deflects it to either side of the shaft. Each bucket makes a complete round-trip in one minute and fifty seconds, the total lift being 555 feet.

Fig. 4 shows a nearer view of the bucket when discharging.

* * *

NEW POWER PLANT AT OTTAWA.

In connection with the new paper mills of J. R. Booth, Chaudiere Falls, Ottawa, is being installed one of the most modern power plants in the Dominion. And although the works are not yet completed, we are enabled, through the courtesy of Mr. J. R. Booth, to place before our readers several special features of this fine motive power equipment.

A general plan of the power-house shows eight 250 H.P. Babcock & Wilcox *forged* steel water-tube boilers, ranged longitudinally along one side, in two groups of four each, separated by a Sturtevant "economizer," and having a 215 ft. "Custodis" chimney opposite the latter, just outside the power house. Space is left in the power house for the future addition of two more 250 H. P. boilers.

Babcock & Wilcox Boilers.

Each of the boilers has 2,823 square feet of heating surface, and is built for a continuous working pressure of 160 pounds per square inch. The two boilers at extreme ends are provided with Babcock & Wilcox patent superheaters, so that they can be used to advantage in the making of sulphite fibre pulp; since the superheated steam enables the digesters to work more rapidly and with less dilution of the acid. In these water tube boilers—of which type 5,000,000 H. P. have already been installed in connection with nearly every important manufacturing industry throughout the world—are embodied all the very latest improvements in modern water tube boiler construction. Each is composed of a number of sections, consisting of a series of 4" tubes, expanded at each end into wrought mild steel headers, which are of such form that the tubes are staggered (or so placed that each row comes over the spaces in the previous row), in order to obtain the most economical results.

The mud-drum—also of forged steel—is placed at the rear and lowest point in the boiler, and the sections are connected with the steam and water drums and with the mud-drum by short tubes expanded into bored holes, thus doing away with all bolts and leaving a clear passage-way between the several parts.

The openings for cleaning—opposite the end of each tube, are closed by steel hand-hole plates, the joints of which are made in the most thorough manner by milling the surfaces to actual metallic contact, and are held in place by wrought steel clamps and bolts.

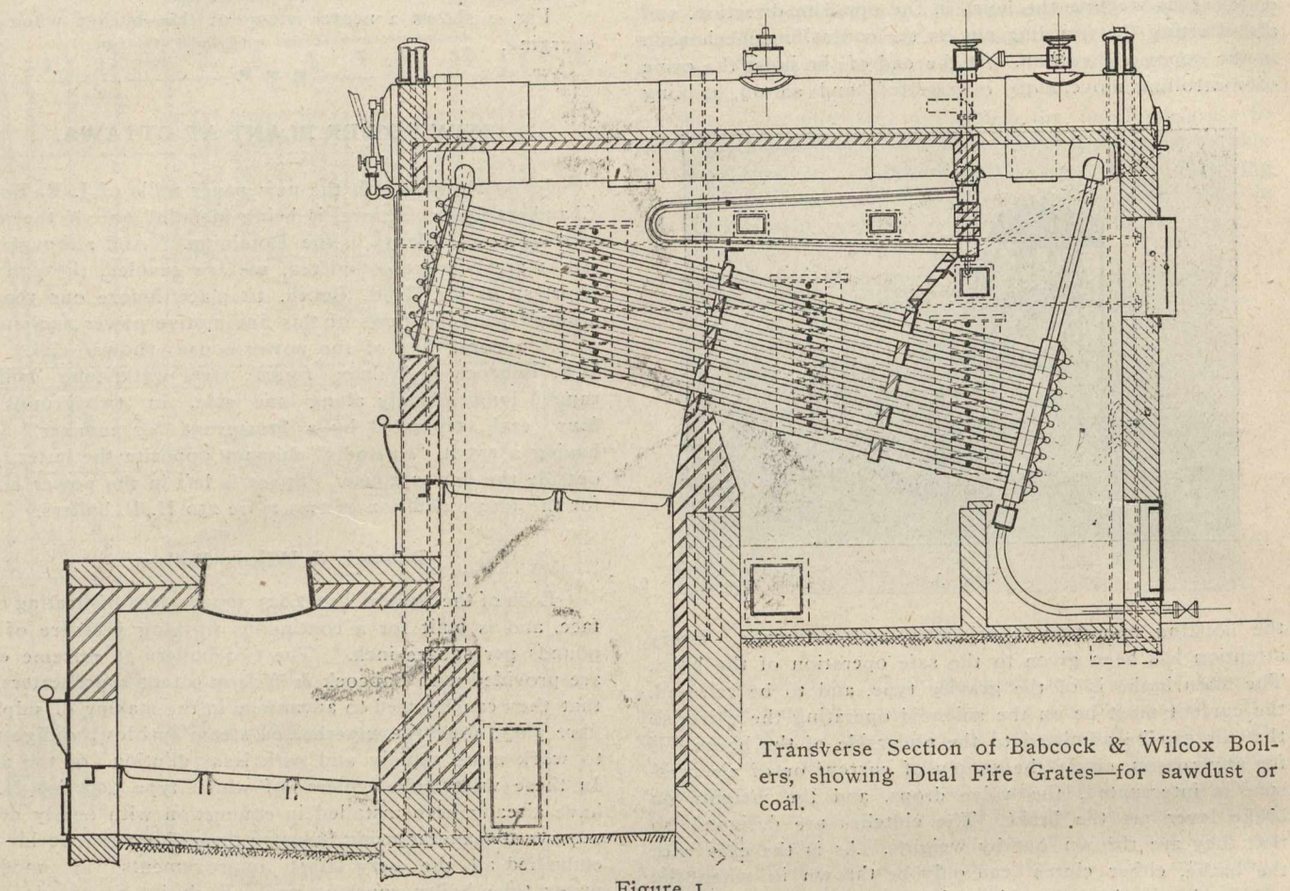
The steam and water drums are made of the best selected mild steel, double rivetted in the longitudinal seams, and tested hydraulically to at least 50 per cent. above the working pressure.

One important constructional advantage of these boilers is, that they are built in sections, and connected without a single stay-bolt. "Staybolts" are the cause of nearly all the trouble in boiler operation, hence, this is a feature of the "Babcock" boiler which commends itself to all practical Engineers. The boilers are suspended independently of the brick work, from wrought iron girders resting on iron columns. This avoids any abnormal stress and straining due to unequal expansion between the boiler and its enclosing walls; thus permitting the brickwork to be repaired or removed when necessary, without in any way disturbing the boiler.

A special feature of this boiler installation is the Dual fire grate arrangement, as illustrated in Fig. 1. The reason for the adoption of this combination of Dutch oven and coal fire grate is interesting.

At the J. R. Booth lumber mills on the southern brink of the famous Chaudiere Falls, are manufactured more railway sleepers, or ties, than in any other plant in Canada; and immense quantities of sawdust are produced. It is estimated that with every thousand feet of the finished product, there is made from 35 to 50 cubic feet of sawdust—depending on the type of saw used. The circular saw producing one-third more dust than the band saw. At one time, the great heaps of sawdust were pushed over the falls and floated down the river. This method of disposal was declared by the Government to be a nuisance, and stopped. Mr. Booth then built a colossal destructor 35 ft. diameter, and 175 ft. high, into which the sawdust from the mills was deposited by means of conveyors, and burnt on a fire grate at the bottom, the gases and fumes from the combustion of this fuel being discharged from an opening in the crown of the dome top, covered with steel netting. This uneconomical burning of a rich carbonaceous fuel is continued day and night, and at the time of our visit the light brown fumes could be observed belching forth into the blue skies over the Chaudiere Falls, and picturesque city of Ottawa; reminding one in that respect of Vesuvius over against the Bay of Naples.

In Fig. 1 is shown a unique adaptation of the old Dutch oven to boiler firing, by means of which the sawdust—hitherto a waste product, and largely a public nuisance—can be used for the generation of steam in the eight 250 H.P. boilers. It is purposed to use the Dutch oven and wood fuel during seven months (the mild season) when the saw-mills are busy; changing off to coal during five months—in the deep winter period, when the lumber mills are practically closed. Mr. J. R. Booth is to be congratulated upon this piece of wise economic engineering.



Transverse Section of Babcock & Wilcox Boilers, showing Dual Fire Grates—for sawdust or coal.

Figure 1.
Dual Fire Grates.

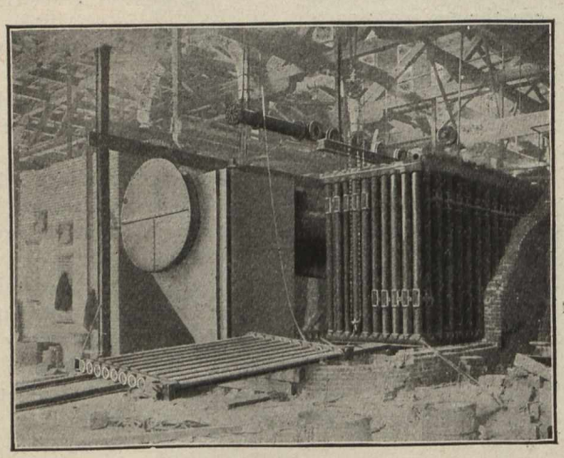


Fig. 2.

Sturtevant Standard Economizer.

In our general description of the power plant, we mentioned that the two groups of boilers were separated by a Sturtevant economizer.

Just as simplicity in design, fewness of wearing parts, and provision for adjustment and repairs are the secrets of success in engine building, so the utilization of waste heat is an unerring sign of good judgment in the design of a power plant. Every Engineer knows that a large amount of heat passes into the atmosphere in the smoke and waste gases. By transferring a portion of this heat to the feed water, the boilers supply a larger quantity of steam, and the coal bill is reduced to a minimum.

With chimney draft, as in the case under consideration, only a comparatively small amount of heat can be taken from the gases since high temperature is necessary for the production of sufficient draft. In an installation including forced draft apparatus, however, a large economizer can utilize much more of this heat, for the fan will maintain the desired draft intensity, regardless of the temperature. To abstract the greatest possible quantity of heat, the pipes of the Sturtevant economizer are arranged "staggered"; that is, the pipes of one section are placed opposite the spaces of the adjacent section, so that by presenting a continuous wall of pipes, the currents of hot gases are thoroughly broken up and made to impinge on the pipes containing the cold water. This arrangement gives a high efficiency and results in a saving of 10 to 20 per cent. in fuel, and an in-

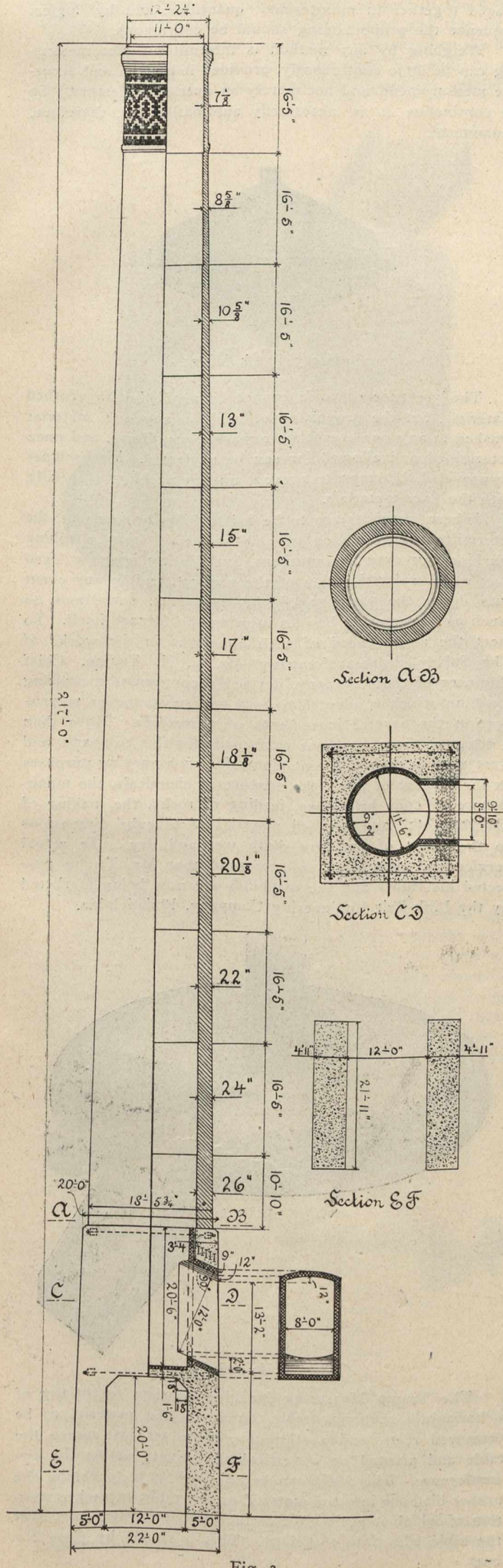


Fig. 3.
Custodis Chimney.

crease in capacity varying from 20 to 40 per cent. according to conditions.

"Custodis" Chimney.

Not the least important feature of this new power installation is the 217-ft. chimney shown in Fig. 6, designed and built by the Alphons Custodis Chimney Construction Co., of N.Y. The lower 42 feet of the chimney is built of concrete protected with a 9 inch fire brick wall, against the influence of the high temperature flue gases. In order to have the chimney in close proximity to the Boiler House wall, it was found necessary to provide an opening 20'-0"x12'-0" in the base, through which the yard railway track is laid, thus

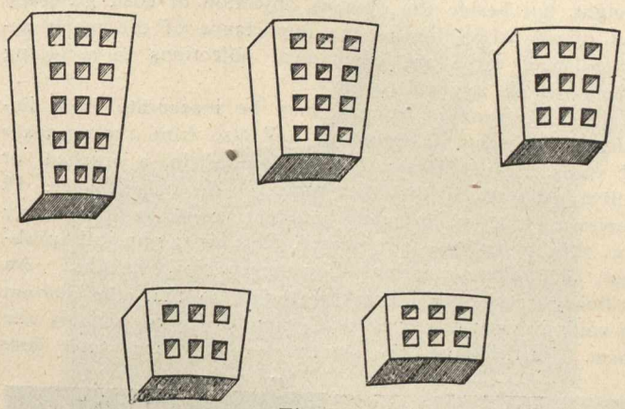


Fig. 4.

allowing for the passage of cars laden with coal and wood fuel along side of building, where the material is discharged through slits in the wall, into the storage bins within the house.

The stack proper is built with perforated radial bricks 6½"x4" on the face and of different lengths as shown in Fig. 4.

These bricks are of a highly refractory material and will stand a temperature of 2,000 degrees F. and have a compression strength of 5,000 pounds per square inch. The bricks are laid up in cement lime mortar and the joints are broken every course vertically and horizontally as shown in Fig. 5.

The perforations in these bricks are made for the purpose of making the mortar go into the same for a distance of 1", thus making a very rigid bond between two courses.

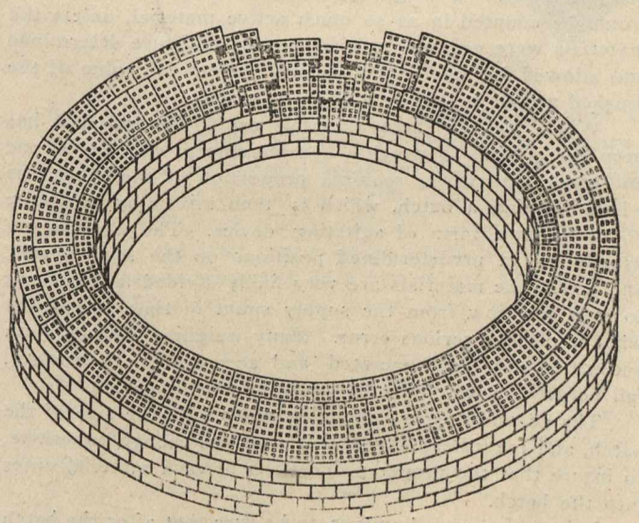


Fig. 5.

The adhesive power of the mortar used with perforated bricks, is three times as much as with unperforated bricks; which means that in a chimney built of perforated bricks, the tension can be three times higher than in chimneys built of unperforated bricks or common brick.

This chimney is artistically designed and substantially built, while its graceful lines and ornate top would have pleased the critical eye of even John Ruskin. In this latter respect, it differs from most of the stacks which disfigure our country landscapes and mar the scenic beauty of our cities.

MEASURING VS. WEIGHING.

Almost all manufacturing processes demand some method of determining mass. The most important commercial properties of mass are cost of purchasing and the chemical and physical results obtained from bringing different predetermined masses into intimate contact.

The usual methods of determining mass are by weight or by measurement, and both are open to objections. Impurities occur which can only be allowed for by chemical analysis, and where the impurities vary, exact results can only be obtained by continually analyzing at close intervals. When this is done mass can be determined very closely by weight, but beside the obvious objection of cost, generally out of all proportion to the importance of the result accomplished, there are mechanical objections to weighing which will be referred to later.

Measurement of volume may be inaccurate from impurities the same as weighing, and also from the presence of voids. Most materials are handled in a crushed or pulverized state, so that the proportion of voids is large. If, however, the voids can be kept constant or nearly so, this objection is obviated. This is a physical problem, and can be solved by mechanical means. An ordinary crusher will break materials so that the amount of voids in even relatively small samples are remarkably uniform. Furthermore, the presence of absorbed water does

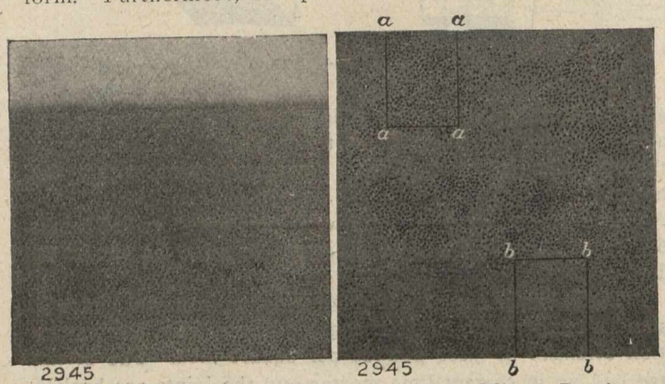


Fig. 1—Unmixed Batch. Fig. 2—Mixed Batch.
Graphic Illustration of Uneven (Batch) Mixing.

not swell the dimensions, but simply fills the voids, causing no inaccuracy. In weighing, however, such absorbed water would be counted in as so much active material, unless the materials were previously dried, or this moisture determined and allowed for, and might seriously affect the value of the finished article and its cost of manufacture.

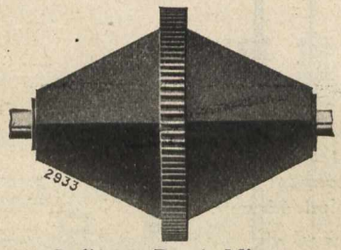
Where two or three materials are to be mixed it has been the custom to weigh a considerable proportion of one and place with it the required proportion of the other, the whole forming a batch, which is then mixed by tumbling about in some form of agitating device. The weights are usually set at predetermined positions on the scale beams, and where the materials are very finely divided it is difficult to stop the flow from the supply spout in time to prevent what is often a serious error. Many weighing devices, both automatic and hand operated and accurate in themselves, fail because of this difficulty with the supply gates.

The economy of weighing increases with the size of the batch, and regardless of size it is possible, though expensive, to insure that the proper proportions of each material enter into the batch.

It is not so easy, however, to be sure that after the batch is mixed each part of the batch is like every other part, or that the mass is uniform. The mixing apparatus may be a tumbling barrel or a paddle trough, but all such apparatus depends on the hap-hazard transfer of one portion of the batch to another, a large number of such transfers being expected to make the mass uniform. There is nothing, however, to absolutely insure this.

If the mass is not uniform and the poorest part is rich enough, then the rest of the batch is too rich, and valuable ingredients are being wasted. Also the larger the batch (and the more economical the weighing) the more mixing is required and the less uniform the mixture. This leads to the conclusion that the materials should be proportioned and placed together in infinitesimal quantities, and by logical sequence the proportioning should be continuous.

Weighing by any method is intermittent, but measuring can be done continuously, provided it be true and accurate measurement, and not merely an average of errors. To be continuous it is necessarily automatic, and, therefore, economical.



Ordinary Batch Mixer.

The presence of voids cannot be avoided with crushed materials, but the proportion of voids in any one material crushed in any one crusher is remarkably uniform, and once determined and allowed for can be neglected. Means must be provided, however, to prevent uneven packing, especially with the finer materials.

Where materials are to be fed to kilns or furnaces, the intermittent introduction of cold materials from weighing machines, or even a continuous, but slightly irregular, feed may cause a deterioration of the product, and in any event cuts down the capacity of the apparatus, sometimes as much as 50 per cent., besides injuring the furnace itself. To meet the urgent need of such apparatus in the works of The Solvey Process Company, Mr. E. N. Trump, Chief Engineer of that company, devised a continuous measuring machine, which is adapted to feed one substance or to proportion the several ingredients of a mixture. More than a dozen of these machines were made for this company, and were used in their different plants for such varying purposes as the feeding of kilns, the mixture of chemicals, the manufacture of coke briquettes, feeding of rocks, the making of concrete, etc., and handled material of 6" cube dimensions to the finest of powders—both wet and dry. In actual service-trial they were so successful that Mr. Trump protected his rights and the machines are now being marketed by the Link-Belt Engineering Company, Philadelphia.

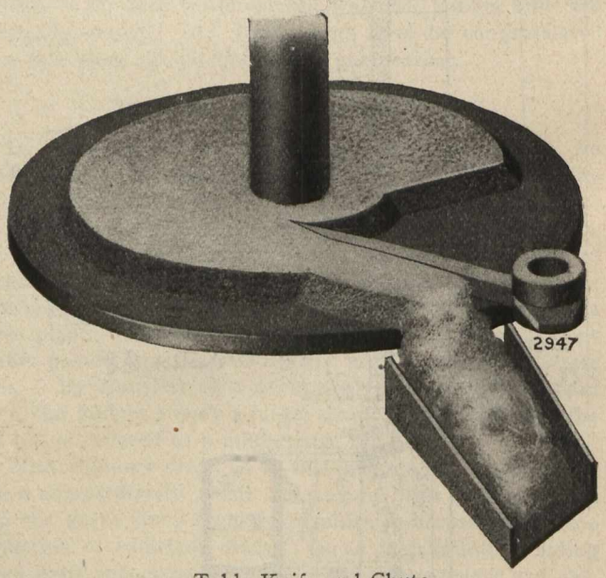
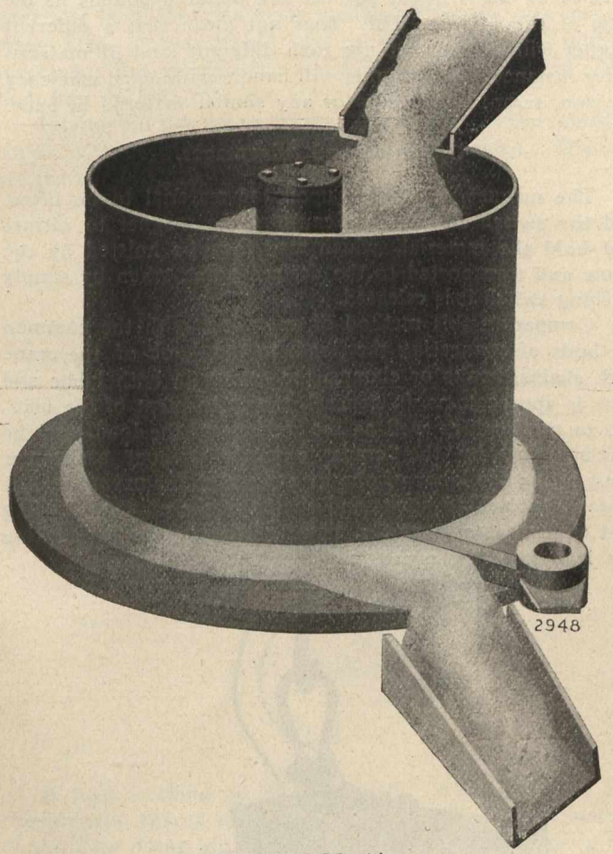


Table Knife and Chute.

The Trump Measuring Machine consists essentially of a horizontal revolving table, on which the material to be measured rests, and a stationary knife set just above the table and pivoted on a vertical shaft just outside the circumference. This knife can be adjusted so as to extend the proper distance into the material on the table, at each revolution of which it peels off a certain amount, which falls over the table edge into the chute. This is shown by plate No. 2947.

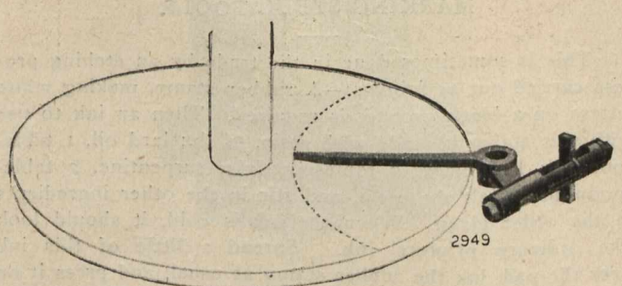
As the material is peeled off by the knife, it must be replenished, so that the pile on a certain part of the table is filled in to approximately the same shape and size by the time it has revolved so as to be again presented to the knife. This is accomplished, as shown by plate No. 2948, by placing a bottomless storage cylinder, somewhat smaller in



Measuring Machine.

diameter than the table and revolving with it, with its lower edge a short distance above the table so that the material flows out from under the edge of the cylinder and assumes a conical shape.

The factors determining the amount measured off are the distance between the bottom of the cylinder and the top of the table, the width of the knife and its depth of cut, and the speed of rotation of the table. The depth of cut of the knife is adjusted by swinging the knife around on its pivot, so that it extends a greater or less distance into the material. This swing is controlled by a screw attached to an arm, cast as part of the knife, and a micrometer scale with pointer shows the amount of movement. This is shown by plate No. 2949.

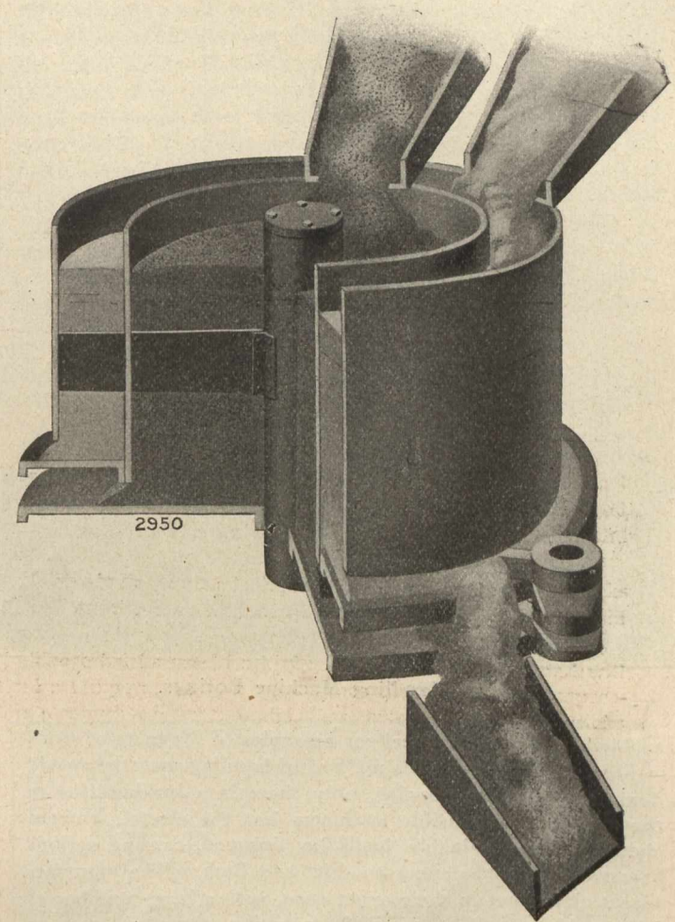


Adjustment of Knife.

Where it is desired to measure off and mix two or more materials, the machines are made with two or more tables, set one above the other, and mounted on the same spindle so that they revolve together, each table having its own storage cylinder above it, and the cylinders being placed one within the other as shown by plate No. 2950.

For each table there is a knife, with its own adjusting mechanism, which allows the user to vary, at will, the percentage of each material in a mixture, and, as the materials flow together constantly and regularly in small streams as they drop down the common chute, each infinitesimal amount of one ingredient is accompanied by the proper amounts of the other ingredients, and the particles become intimately mixed.

In feeding materials to the storage cylinders of these machines a conveyor can be employed; they can be delivered by gravity from a storage bin, or they can be shoveled; and it is only necessary to see that enough is kept in the storage cylinders so that the amount which the knives peel off will be constant. With some finely powdered materials, which



Measuring and Mixing Machine.

flow very freely, it is necessary to place feeding-seals at the top of the storage cylinders to regulate the density and pressure on the material below, so that it will not pack or flow out at the bottom too rapidly and flood the table.

The tables and storage cylinders are all mounted on and driven by the same centre sleeve, which is carried on a dirt-proof step bearing with hard bronze and steel washers and proper oiling device. The lowest table has a bevel gear cast on the under side, and is driven by a pinion mounted on a countershaft. The casings of the machine are made dust-proof to avoid any possibility of leakage or pollution of the air by finely powdered materials, and the whole is mounted on a substantial base, thus making the machine entirely self-contained. The countershaft can be connected up to an electric motor by direct gearing, or can be driven by means of a belt and pulley.

* * *

—For the purpose of showing the usefulness of the agricultural motor, an interesting demonstration has been given on Mrs. K. Kendall's farm, near Biggleswade. The field was illuminated by acetylene gas, and, drawing two 6-ft. mowers, the motor cut fifteen acres in 3 hours and 35 minutes, the start having taken place at 9 p.m. The demonstration was given to show that the motor can be used day and night, so enabling a field to be mowed or ploughed in the shortest possible time.

LIFTING MAGNETS.

One of the most useful labor-saving devices on the market to-day, for the handling of materials in iron and steel works, is the Lifting Magnet. Innumerable are the forms in which it is applied: pig iron, light and heavy scrap, steel ingots, blooms, billets, slabs, plates, sheets, rails, structural shapes, spikes, rivets, cotter pins, machine shop borings, etc.

Through the courtesy of the Electric Controller and Supply Company, of Cleveland, Ohio, U. S. A., we are

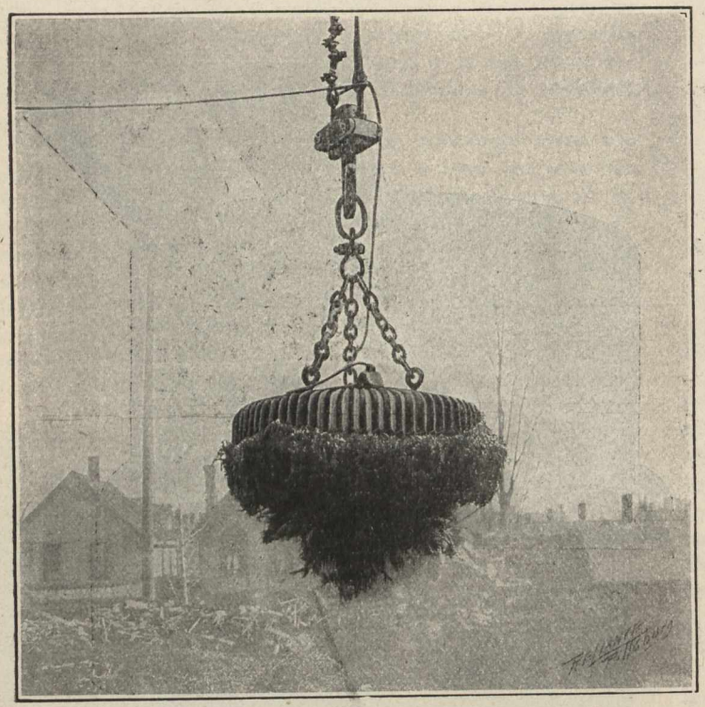


Fig. 1.—Handling Machine Borings.

enabled to give three excellent examples of Magnets at work in Figs. 1, 2, and 3. This method of handing material would doubtless be more popular, only there is a lurking fear in the minds of responsible engineers lest the electric current should fail and valuable loads be dropped, causing serious financial loss, and danger to life and limb. The manufacturers claim that in their experience, with a large number of Lifting Magnets in successful operation, they have yet to learn of a single accident which has occurred through their use; while on the other hand accidents due to the slipping and breaking of hooks are known to be of frequent occurrence.

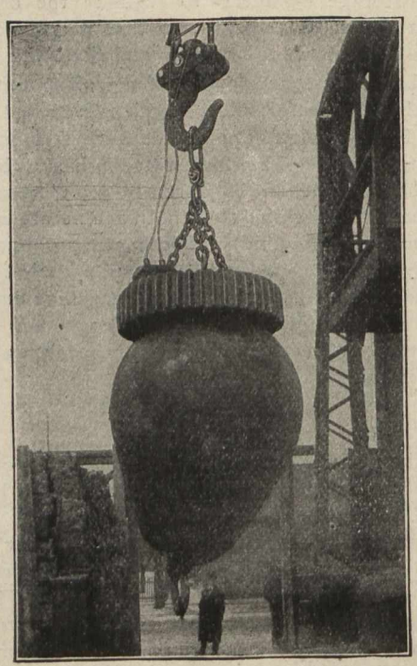


Fig. 2.—Lifting Skull Cracker: Weighing 11,000 lbs.

It will be perceived by illustrations Figs. 1 and 3 that a single design of Magnet is not adapted to all kinds of material; on the contrary the magnet must in every case, be designed to suit the form of material to be handled. A magnet, for instance, which would handle five tons in the form of an ingot might not lift five hundred pounds in the form of thin plates. This does not mean that a different magnet will be required for each different kind of material as for instance, a pig magnet will handle with equal efficiency pig iron, scrap, rivets, nuts or any similar material in bulk.

Operation and Advantages.

The magnet is lowered upon the material to be lifted, and the switch closed, thus causing the magnet to attract and hold the material, which may then be hoisted by the crane and transported to the desired point, when by simply opening switch it is released.

Comparing this method of operation with the common methods of connecting the load to the hook of the crane with chains, hooks or clamps, the saving in both labor and time is apparent; as, in general, the attachment of the magnet to the load, as well as the release of the load, may be accomplished by the crane operator without assistance, thus saving the labor of one or more men for prying up the material, attaching hooks and chains at the point of loading and additional men at the point of delivery for unhooking the load from the crane.

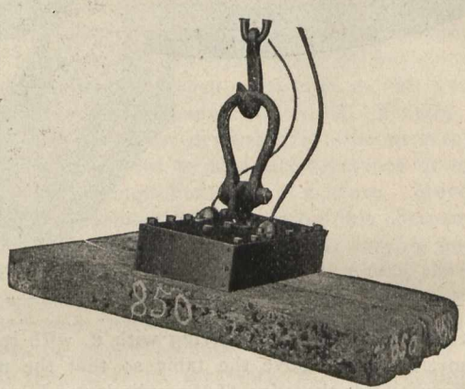


Fig. 3.—Handling Steel Billets.

Magnets can be so quickly attached to and detached from a load that by their use the work which may be done by a given crane is greatly increased, and in some cases more than doubled. It frequently occurs that the attachment of lifting magnets to existing cranes so increases their capacity for handling material that the purchase of additional cranes for handling an increased output is rendered unnecessary.

* * *

MARKING STEEL TOOLS.

This is sometimes done in the trade by an etching process carried out as follows:—A rubber stamp, making white letters on a black ground, is required. Then an ink to use with this stamp is made with resin, ½ lb.; lard oil, 1 tablespoonful; lampblack, 2 tablespoonfuls; turpentine, 2 tablespoonfuls. Melt the resin, and stir in the other ingredients in the order given. When the ink is cold, it should look like ordinary printers' ink. Spread a little of this ink over the pad, ink the rubber stamp as usual, and press it on the clean steel—on a saw-blade, for instance. With a strip of soft putty, make a border round the stamped design, as close up to the lettering as possible, so that no portion of the steel inside the ring of putty is exposed except the lettering. Then pour into the putty ring the etching mixture, composed of 1 oz. of nitric acid, 1 oz. of muriatic acid, and 12 ozs. of water. Allow it to rest for only a minute, draw off the acid with a glass or rubber syringe, and soak up the last trace of acid with a moist sponge. Take off the putty, and wipe off the design with potash solution first, and then with turpentine.—"Work."

THE FORD COMPOUND STEAM TRAP.

Ninety per cent. of the float traps on the market are simply petty modifications of the primitive idea of a float operating a small valve. Farcically extravagant have been the claims made for most of them; nearly all of which have proved lamentable failures in practice. Hence, steam users generally have about as much confidence in any new idea in steam traps as they would have in a new perpetual motion machine. But viewing the steam trap as a necessary evil, they buy the one with the fewest faults.

Having put our finger on the trouble, what is the remedy? Think in another direction. Truth is many sided. Diverse are the roads to success.

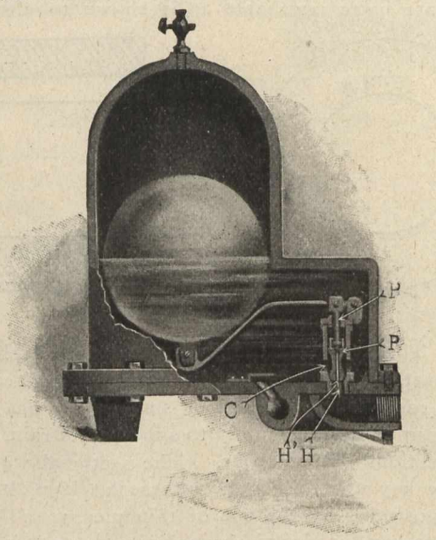


Fig. 1.

A trap working on 80 to 100 lbs. steam pressure has considerable energy confined within its walls. Now, instead of the float doing all the work why not use some of the stored energy to open and close the outlet valve; and then by making the outlet orifice of ample area—for the size of outlet determines the capacity—not only is the capacity increased, but the evil of a "plugged-up"-valve is eliminated. But how is this potential energy to be controlled? How can we use it for opening and closing the valve? Suppose we use the float as the co-ordinating power, the prime mover,

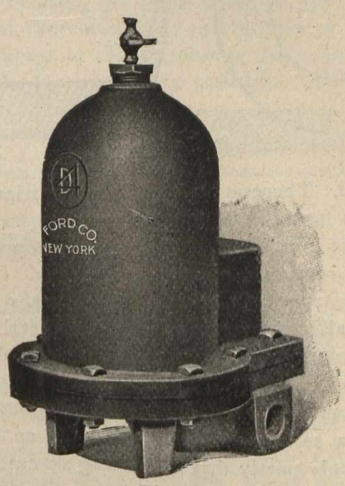


Fig. 2.

the "brain" of the machine. Then we can control this potential energy, so that it does useful work, i. e., it opens the large main valve when actuated by the float and closes the valve when the water level drops below a given point.

Such is a brief statement of the mechanical principles embodied in the Compound Steam Trap. It will be seen that instead of describing it as a "float" trap, it might be correctly termed a power trap; since it gets to its work quickly and positively—opens wide, or closes tight.

The Ford Compound Steam Trap can also be applied to very low pressures. If the pressure falls to zero, then the float alone is of sufficient power to operate both valves. The manufacturers claim that this device has the greatest amount of power and capacity in the smallest space. The Ford Trap has been well tried on all pressures, and has probably not an equal when applied to extreme high pressures. This is self-evident, when one remembers that it is a "power" trap; and that the higher the pressure the more energy there is behind it.

The principal feature in the Ford Compound Steam Trap is, to keep the water level at a given point, so as to provide a constant seal to the outlet valve. As the water rises the float lifts the small piston P', and the pressure which has accumulated on top of the large main piston P' escapes through the small port H'; then the pressure, which is always admitted through the holes C' to the under side of the main piston P, throws the latter open, and the main discharge passes out through H. This position is maintained until the water level falls, when the small piston P' again seats itself. Then the pressure accumulating on top of the large main piston P closes it. This action is very rapid, it will be perceived, therefore, that the Ford Compound Steam Trap is always ready to take care of a sudden influx of water, and keeps the system dry right up to the trap.

The Canadian Fairbanks Company, Limited, Montreal, have been appointed sales agents for this trap, in Canada.

* * *

NOVEL OSCILLATORY ENGINE AND CRANK MOTION.

(As Invented by C. G. Holmberg.)

The problem of "dead centring" has always been an attractive one to engineers and inventors, and various are the mechanisms which have been devised to overcome the dead points on a crank motion. There is a great waste of power at the dead point, and each successive age has attacked the problem, usually by the use of mechanical combinations

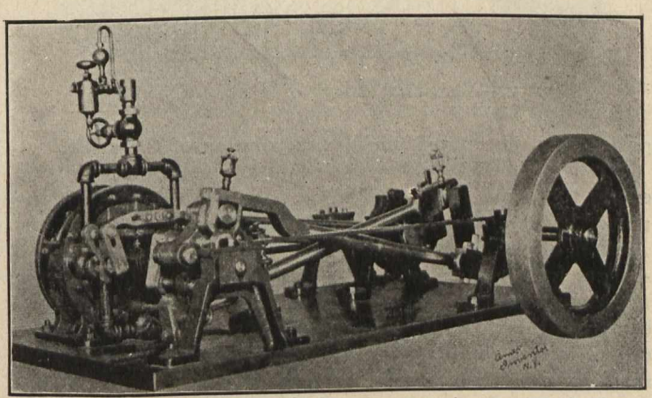


Fig. 1.—Perspective Showing the Novel Crank Motion.

of such complication that they used up more power in preventing dead centring than the dead centring itself.

We show in the accompanying illustration a late solution as worked out by Mr. Charles G. Holmberg, of Woonsocket, South Dakota, on which the inventor has been experimenting and working for some thirty years, and which he has at last brought to practicability in the 25 horse-power engine shown. He has now nearly completed at the Union Iron Works, at Minneapolis, a 300 horse-power engine on the same general pattern.

One of the important differences between the Holmberg engine and others is that instead of the piston being rectilinearly reciprocating, or rotary, it is a combination of the two; in other words, a rotatively reciprocating piston.

The cylinder consists of an outer casing through which passes a central shaft carrying radial wings or piston-heads. The cylinder is divided into two chambers, as shown in the sectional view, and each wing projects into one of the chambers. In the two partition walls of the chambers are induction and eduction passages and ports controlled by oscillating valves. It will thus be seen that this construc-

tion forms a double piston controlled by double oscillating valves. The piston transmits its oscillatory rotations to the driving shaft, which, through an ingenious crank motion, is translated into a rotary motion of a driven shaft. The cylinder valves are operated from an eccentric on this rotating shaft.

The crank is made in two sections pivotally connected with each other at adjacent ends by links, and the crank sections are pivoted on opposite sides of the links on the fork arms carried by the main shaft. The pitmen have their wrist-pins adjustably secured in the outer portions of the crank sections. By this arrangement the pitmen can be properly adjusted relatively to the sections. The fork-arms on the oscillation of the piston and shaft carry the crank-sections along so that the pitmen and crack-arms impart a rotary motion to the main shaft. The action of the fork-arms on the crank-sections is such as to impart simultaneous motion to the crank-sections in opposite directions, and as the crank-sections are connected with each other by the links, the sections act on their pitmen to push the one and pull the other, so that the shaft receives at all times power from two points. As the shaft, with its fork-arms oscillates, and the main shaft, with its crank-arms rotates, it is evident that the crank-sections on each full oscillation of the driving-shaft, and the corresponding full revolution of the driving shaft assume different positions relatively to each other and to the crank-arms. The crank-sections stand in alignment with each other during part of the revolution given to the shaft; but when the pitmen cross each other the double cranks move into angular positions to avoid dead-centre positions and at the same time compensate for the different

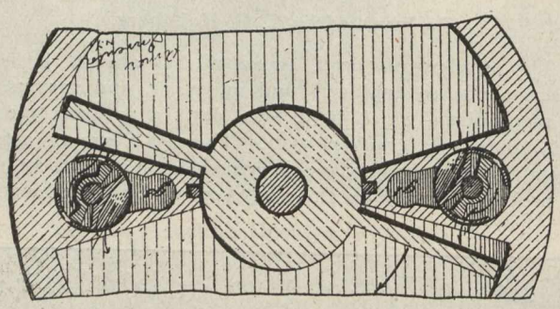


Fig. 2.—Sectional View of Piston Cylinder.

position of the pitmen during a revolution of the shaft.

It is claimed for this engine that any force on the piston exerts the same amount of force upon the driven shaft, no power being lost through dead centring, or through the friction of the cross-heads or the grades; thus the engine realizes from two to two and a half times more power from the same amount of fuel expended. Another advantage arising from the even balancing and the semi-rotation about a centre is the elimination of vibration, due to the alternate rectilinear movement of the ordinary piston.

The inventor has protected the engine, its valve mechanisms and its crank motions by many patents. He intends to apply the principles of his construction to gasoline and other explosive engines as well as steam engines, and particularly to engines designed for small power plants.—"The American Inventor."

* * *

WHAT CONSTITUTES A TON WEIGHT?

My attention has been called recently to a complaint addressed to the secretary, Manchester Chamber of Commerce, made by an importer of chemicals from Canada, as to what he considered an injustice in the matter of a ton weight. He bought at a price per ton, and as 2,240 pounds constitute a ton in Great Britain, he expected to receive that weight from the Canadian seller, but as he received 2,000 pounds for a ton, the recognized weight in Canada, he feels he has a grievance. Would it not be well to quote 2,000 pounds for a ton and avoid friction?

P. B. MacNAMARA.

[From weekly report issued by Department of Trade and Commerce, Ottawa, October 2nd, 1905.]

TALKS ON KEYS FOR ELECTRICAL MACHINERY.

(Our Special New England Correspondent.)

Figure 1 shows one of the most troublesome types of keys used for the adjusting of hubs, flanges, couplings, gears or pulleys for electrical devices. The defect consists in the lack of the key to make a proper grip on the smooth surfacing of the shaft. Usually the key is slightly bevelled, and the smaller end first inserted in the keyway of the hub as at A. The key is then driven through and the tapering sides grip the sides of the keyseat well, but often the adjustment to the oval portion of the shaft is poor. The flat key is also seen in service in some of the electrical contrivances, and these forms of keys are quite unreliable as is shown to electrical ma-

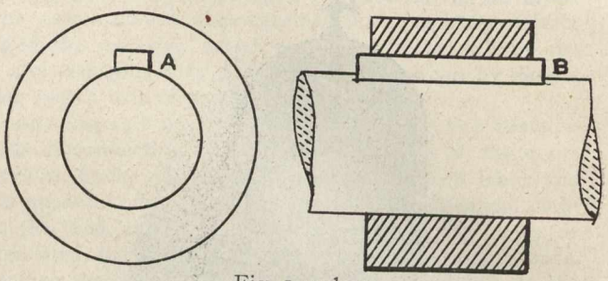


Fig. 1 and 2.

chinists. The keys lack the ability to fix themselves to any definite part, as in the case of the provided key-seat. I have observed cases where the flat or smooth key has been used in important connections, only to slip under strain, and throw the connections out of order. The sectional view Fig. 2, shows the key at B. I have seen these flat keys strengthened in their positions by the use of thin pieces of sheet metal. The square key for electrical machinery parts is undoubtedly used with greater freedom than any other style. This key is exhibited at C, Fig. 3. One of the difficulties with this key, in the speedy electrical machines, is that it is often made with excessive taper, hence the tendency to jar itself loose is apparent. In order to obviate this trouble the key is often wedged in place, or perhaps a set-screw is used to bite down on the key. A sectional illustration of the key is shown

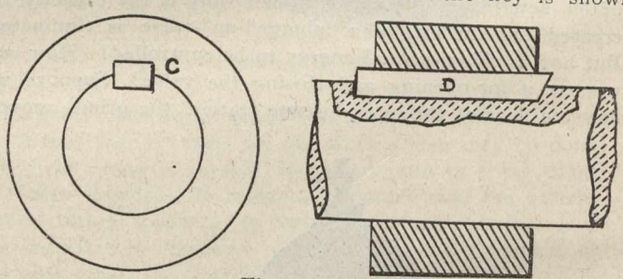


Fig. 3 and 4.

in Fig. 4 at D. There is an equally proportioned adjustment of the key so far as balancing the same midway between the shaft; and the connected part centre is concerned, and this adds to the retaining power of the key. Still I found numerous instances in which these types of keys were patched and altered by means of sheet metal strips inserted above or below, or on the sides, filling out the space in the seats of hub or flange. Furthermore, I noticed cases in which the keys had been used with proportions too large, resulting in a splitting of the hub. Or as in some cases, the key was only partly driven, leaving an extension to which clothes, belts, etc., might be caught.

The Headed Key.

Keys with heads or flanged shoulders for drawing the same are in use in some lines of electrical machinery devices. Some builders of modern types of electrical contrivances believe in a key that may be removed by inserting the edge of a cold chisel at the back of the head or shoulder and drive out the key thereby. This form of key is presented in Fig. 5 at E. The sectional drawing in Fig. 6 shows the key head at F. The lip forming the head serves to check the key from going in too far on the seat. This form of key has been in vogue since the beginning of the erection of machinery, and

for special purposes is exceedingly useful. Many electrical machinists, however, avoid using the key for fear that the head may protrude and catch objects; or, that the head may be chipped off in time by the edge of the cold chisel; leaving the key main in the seat. The common driven-through key is used more freely.

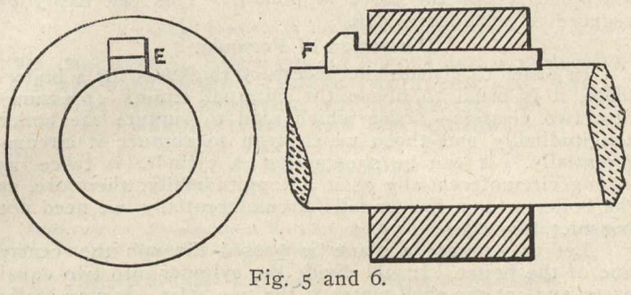


Fig. 5 and 6.

Setting the Key with Threaded Screw.

The employment of the set-screw for retaining a key in place in a seat has been in service by electrical machinists for a long while. The plan employed is illustrated in Figs. 7 and 8. The former shows the plan of the set-screw G as it relates to the combination of the collar or flange, and the shaft. The point of the set-screw is calculated to strike the centre of the key as at H in Fig 8, and retain the key in place in the seat by the pressure exerted thereupon. The result is

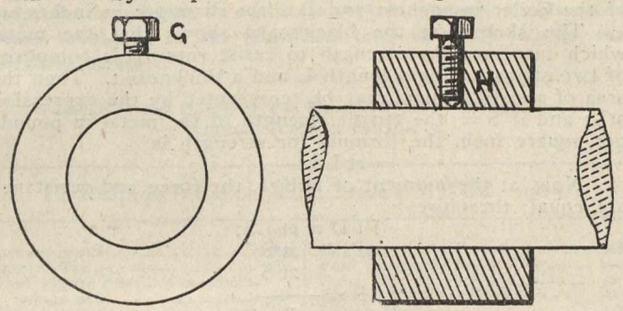


Fig. 7 and 8.

that the key is pretty well secured. If the set-screw works loose, the usefulness of the same is nil. Often these set-screws get bent over, in which case considerable trouble is experienced in getting the set-screw removed and substituted with a new one. The flat point is preferred for the penetrating or pressure end of the screw. In the event that a decided point is used, the point pricks a place in the metal of the key, and thereafter it is difficult to set the screw point anywhere except in that particular depression. This bothers in getting the key set to any new adjustment.

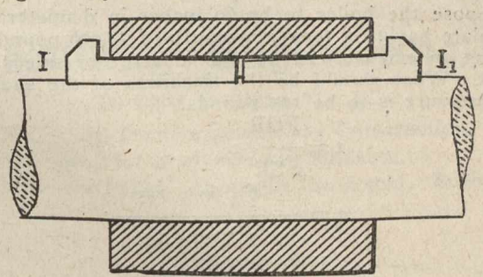


Fig. 9.

The Double Key System.

In examining the work of different electrical machinists in various plants, one finds some odd examples of mechanical adjustments with set-screws, keys and the like. The two-key or the double-key system is by no means an oddity in the electrical machinery adjusting system. Fig. 9 is a cross sectional illustration of the adjustment of two steel keys inserted from either end. These are marked I_1. The chief trouble I observed in the employment of the double-key system consisted in the use of keys a little too long, so that the stubs of the keys would butt in the centre of the flange before the keys were sufficiently tightened on the sides or bottom. Consequently, unless the precaution is taken to chip off the ends and drive deeper, or to pack the keys with thin strips of sheet metal, the union would lack security and the keys work out and liberate the parts.

The Three-Cornered Key Idea.

The three-edged key design is something of a novelty. This plan is presented in Fig. 10, and consists in the using of two or more keys made with three edges instead of four. Just what the object is could not be ascertained. The drawing shows the mode of application. The key-seats are specially constructed for the peculiarly shaped keys as represented at J. J. The keys are slightly tapered so that in driving, the parts are rendered more secure the deeper the insertion. This form of key adjustment is not perfect, and is not used very frequently. Keys with weak parts at the union of the shoulder and head are common.

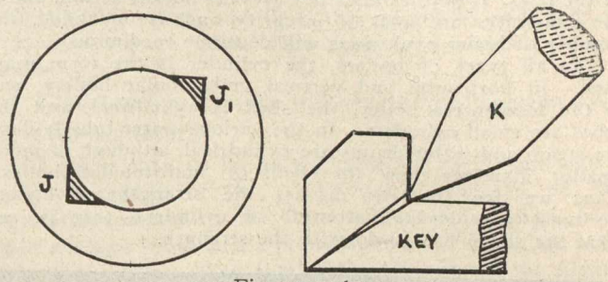
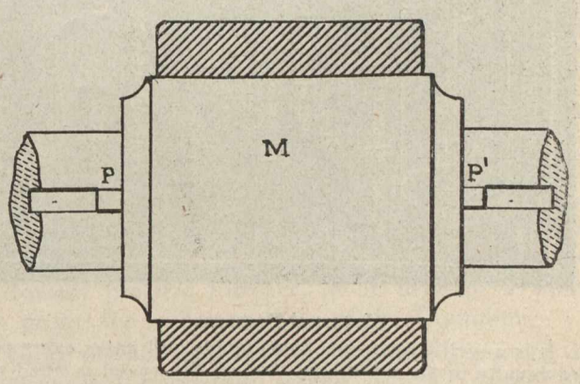


Fig. 10 and 11.

Consequently when an attempt is made to drive the key back with the point of the cold chisel as at K, Fig. 11, the edge of the cold chisel often cuts into the metal and the head is chipped off. This may not occur the first time, but will in course of constant removal of the key. If a liberal proportion of metal is allotted for the neck of the key at the juncture of the head, the life of the key is prolonged. Usually the keys are superior grades of steel, in which case a cold chisel does not cut deeply when used for removing a key. I have met with cases in which metal of soft and inferior substances have been used for keys and these keys have weakened and become useless in a little time. Then again I have contended with keys so brittle that the metal snaps off in the ordinary process of driving or removal.

Keyed Inner Journal.

In modern electrical machinery one finds frequent cases in which the adjustment of bearings is of the order illustrated in Fig. 12. This is a sectional sketch of the combined journal and shaft with keys. The arrangement of the bearing is such that there is an inner sleeve m which is of brass, as a



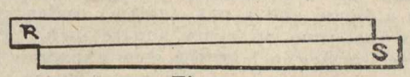


Fig. 12

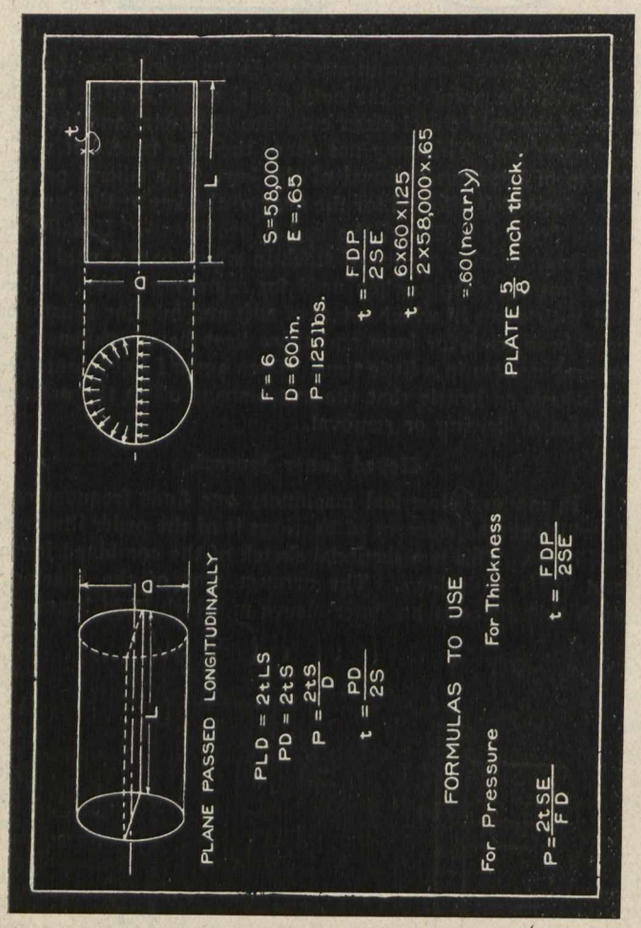
rule; and this sleeve is keyed to the shaft by means of the keys P, P, on either side. The hub or outer bearing is marked N. I saw that in some of the adjustments of this description that the double key plan R and S was employed. This involves the insertion of one key into the key-seat above the other key. There is a base key and a secondary key. The base key is first inserted and driven home, and then the secondary key is placed in position, and the two keys locked by vigorous driving. The keys usually lock in such way that they retain a secure grip in their respective positions regardless of vibrations.

Strength of Boilers.

The frequency with which we read of serious boiler explosions brings home to us the necessity of making steam generators very strong. People living and doing business in a large city do not realize that in the basement of many a building there is but a thin covering over steam and hot water having sufficient energy to blow to pieces the entire building.

Usually, when a boiler explodes, there is considerable loss of property, and frequently loss of life. The various state governments are trying to reduce the number of these accidents by providing frequent inspection, and by allowing only men of knowledge and ability to have charge of boilers. These methods are of great benefit, and have already shown the practicability of the laws. If politics does not prevent honest action, and if the examiners are men of integrity and are qualified, the number of boiler explosions will continue to diminish.

In all types of boilers, the cylinder is the form most used. In horizontal and vertical multitubular boilers, and in the locomotive boiler, the shell is cylindrical, and the tubes are small cylinders. In the various water-tube boilers, the steam and water drums are cylindrical, although of much smaller diameter than the shells of multitubular boilers. Thus we see that to discuss the strength of boilers we must consider the strength of cylinders—that is, see what the shape has to do with the strength.



Internal Pressure.

It is a well-known fact that liquids and gases exert pressure equally in all directions; that is, if a vessel is filled with a liquid or a gas, there will be the same intensity of pressure on a square inch at the top as on a square inch at the bottom. As a steam boiler is filled with a liquid and a gas (steam) under pressure, the pressure is the same on every square inch. The pressure on any given square inch of the steam space is the same as that on any square inch of the water space. This, however, is not strictly true, for if the weight of water is considered, the pressure at the bottom is a little greater than at the top; but, as this is very small, it is not allowed for.

In most boilers, the pressure of steam within is far in excess of the pressure outside—usually from four to twelve times as great. This pressure tends to burst the shell-plate; and, to prevent this, the plates must be very strong and reliable.

Testing Material.

Before discussing the subject further, let us find out how the actual strength of the boiler metal is determined. A little thought shows us that the metal shell gives way by being torn, and that the force acting is a pull, not a shearing nor a compressing stress. The force that holds the particles together and resists this pull is called tensile strength. If it takes 60,000 pounds to pull apart a bar of iron one square inch in cross-section, that bar has a tensile strength of 60,000.

To find out how much a given piece of boiler plate will stand—that is, to find its tensile strength—a sample strip is placed in a machine and broken; while tearing it apart, the machine records the force in pounds. This can easily be reduced to per square inch.

Derivation of Formula.

In order to discuss the necessary thickness for a boiler-plate, it is usual to divide the internal strains (pressure) into two classes:—Those which tend to rupture the boiler longitudinally and those which tend to rupture it circumferentially. It can be shown that a cylinder is twice as strong circumferentially as it is longitudinally; therefore, as the boiler seldom if ever fails circumferentially, we need not consider this class.

Let us suppose a plane is passed through the centre line of the boiler. It will divide the cylinder into two equal parts, and cut the shell-plates at the two sides. It may easily be proved that the pressure acting on the curved (concave) surface is equal to that acting on the plane passed through the boiler. This is indicated by the small arrows of the second figure.

Then the pressure, or force, tending to lift the upper half of the boiler from the lower half is evidently the area of this plane (in square inches) multiplied by the steam pressure (in pounds per square inch). This may be expressed as:

$$L \times D \times P, \text{ or } PLD,$$

if P = the steam pressure per square inch; L = the length of the boiler in inches; and D = the diameter in inches.

The sketch on the blackboard shows that the metal which furnishes the strength to resist rupture is composed of two strips having a length L and a thickness t. Then the area of resisting metal may be represented by the expression 2tL; and if S = the tensile strength of the metal in pounds per square inch, the formula for strength is

$$2t\,LS.$$

Now, at the moment of failure, the force and resistance are equal; therefore,

$$PLD = 2t\,LS;$$
$$PD = 2t\,S;$$
$$P = \frac{2t\,S}{D};$$
$$\text{or, } t = \frac{PD}{2S}.$$

If, now, we let E = the efficiency of the riveted joint (that is, the percentage of the strength of the joint compared with the strength of the solid plate), and F = the factor of safety,* the formulæ become:

$$P = \frac{2t\,SE}{FD}; \text{ and } t = \frac{FDP}{2SE}.$$

An Example.

Let us now calculate the thickness of a boiler-shell for a practical case:

Suppose the boiler to be 60 inches in diameter, and of boiler-plate having a tensile strength of 58,000 pounds. The joint has an efficiency of 65, and a factor of safety of 6 is allowed. What should be the thickness of the shell-plates if the pressure is to be 125 pounds?

$$t = \frac{FDP}{2SE};$$
$$t = \frac{6 \times 60 \times 125}{2 \times 58{,}000 \times .65};$$
$$= .60 \text{ (nearly)};$$
$$= \tfrac{5}{8} \text{ inch (nearly).}$$

Now let us find the allowable pressure for a steam drum for a water-tube boiler. Assume a tensile strength of 60,000 pounds, a factor of safety of 5, an efficiency of .60 for the joint, and the plate ¼ inch in thickness. The diameter is 3 feet.

$$P = \frac{2t\,SE}{FD};$$
$$P = \frac{2 \times \tfrac{1}{4} \times 60{,}000 \times .60}{5 \times 36};$$
$$= 100 \text{ pounds}$$

By means of the two formulæ given on the blackboard, any problem involving thickness or allowable pressure can readily be solved.—(Carl S. Dow, in "The Technical World.")

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*NOTE.—In using engineering materials, it is customary to make the machine 4 to 10 times as strong as is necessary by the calculation; this to allow for imperfect metal and workmanship. This ratio is called the "factor of safety."

The Canadian Engineer.

ESTABLISHED 1893.

With which is Incorporated

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TORONTO, CANADA, DECEMBER, 1905.

ANNOUNCEMENTS.

On and after December 1st, the price of "The Canadian Engineer" will be 15 cents for single copies.

This number contains eight extra pages, four of which contain the yearly index.

Subscribers possessing unbound copies of this Journal for July, 1905, will receive 10 cents for each copy, upon returning same to 62 Church Street, Toronto.

Owing to lack of space, article III., on Descriptive Metallurgy of Iron and Steel: Ores of Commerce, has been omitted; but will appear in our January issue.

Electric Smelting: Academic Judgment Thereon

When it was proposed to cross the Atlantic by steamship from New York to Liverpool, Dr. Lardner, —who in his generation, held about the same rank in the so-called scientific world that Lord Kelvin does to-day—made the following declaration in a public lecture at Liverpool, December, 1835:

As to the project, however, which was announced in the newspapers, of making the voyage directly from New York to Liverpool, it was, he had no hesitation in saying, perfectly chimerical, and that they might as well talk of making a voyage from New York or Liverpool to the moon.

Gladstone once made this startling allegation over his own signature:

I affirm that, so far as we know the facts, and with a possible exception or two, the popular judgment on the great achievements of the last half-century, which have made our age (thus far) a praise among the ages, has been more just and true than that of the majority of the higher orders.

We have introduced these two quotations, with a view of illustrating the important truth, that the *tendency* of the academic mind is to stifle mechanical instinct, and to narrow the range of vision. Of this pyschological trait, we have had two typical examples recently. Before us is Vol. XVIII. (Jan. 1904), Transactions of the Canadian Society of Civil Engineers. In a paper by Dr. Stansfield, of McGill University, on "The Electro-thermic Production of Iron and Steel," occurs this pessimistic statement, (P.83):

The electrical smelting of these ores (titaniferous) for ordinary pig iron, has not, I believe, been attempted, and even if it were technically successful, it would be difficult to produce the iron sufficiently cheaply to compete with blast furnace iron.

A parallel to this Canadian deliverance is found in the columns of our British contemporary, "The Iron and Coal Trades Review," July 21st, 1905:

In these columns we have several times expressed an opinion, that electric smelting—while possibly economical enough for producing tool steel from other descriptions of iron—**is absolutely out of the running for the manufacture of ordinary descriptions of iron and steel.**

If the McGill Professor, and our British contemporary are right, then the Canadian Government—acting upon the advice given, and evidence gathered by their Superintendent of Mines, Dr. Eugene Haanel—is on a wild goose chase, in spending $15,000 at Sault Ste. Marie just now, on experiments with an improved Heroult Electric Furnace, in an attempt to smelt at a profit, the refractory ores of the Dominion.

Since the publication of the luminous report of the Government Commission, issued August, 1904, "The Canadian Engineer" has taken an affirmative stand on this question of Electric Smelting; the solution of which is of such momentous importance to the iron and steel industries of Canada. And based upon private data in our possession, we are more than ever convinced that the experiments which are to actively commence two weeks hence at Sault Ste. Marie, with an electric furnace having a capacity of two tons of pig iron per 24 hours and capable of absorbing 300 E.H.P.,—under the superintendence of Dr. Haanel, will prove a commercial success.

In refreshing contrast to the Cassandra-like prophecies cited, is the recent enunication of Dr. J. W. Richards, one of the ablest metallurgists on the American continent—head of the Department of Elec-

tro-Metallurgy of Lehigh University, author of "Metallurgical Calculations." A man in whom *active* impressions greatly preponderate over the *passive*, hence his broad-minded view. Here is what he says about the Canadian experimental project:

I believe you are on the eve of some surprising results in electric furnace work. All that is now needed is the perfection of the electric furnace, so that it will run regularly, and produce a steady quality of iron on a large scale. Perfect the furnace so that it runs as regularly as a blast furnace, and you have the latter beaten, even **where fuel is cheap.** The reason: only quarter ton of fuel is theoretically needed in the electric furnace per ton of pig iron, the issuing gases can all be used in gas engines to produce power and quarter ton of fuel can be saved per ton of pig iron, including the fuel burnt for power. The only stumbling block now is the imperfection of the electric furnace as a metallurgical apparatus—**its efficiency is all that could be desired.**

Sheldon Amos in his "Science of Law," defines a statesman as "he who can best interpret the voice of the people." In the matter of this experimental project at the "Soo," the Canadian Government has exhibited the highest capacity for leadership. Canada has reached a crisis in her history. Her broad lands are rich in mineral resources, but unfortunately, the iron ores are largely refractory, and incapable of reduction to a metallic condition by the conventional methods of smelting. Something heroic had to be done. And it redounds to the credit of the responsible Ministers that in spite of *ex-cathedra* pronouncements from halls of learning, skeptical criticisms of conservative editors and others, they had the wisdom to hearken to the plea of their practical advisers,—appointed a Commission, and upon the evidence adduced, took action which has culminated in the installation of the finely equipped experimental Electrical Furnace plant at Sault Ste. Marie.

Editorial Notes

Gas Turbines Impossible In Our Present Stage of Knowledge

It is conceded—especially since the introduction of Suction Producer Gas generating systems—that for general power purposes, the gas engine may be regarded as the prime mover of the future; and, since the turbine is daily winning favor, it is not to be wondered at that our foremost Engineers are already attacking the problem of the gas turbine, and that invention claims are rolling rapidly into the Patent offices.

In his presidential address before the Junior Institution of Engineers, England, November 3rd, 1905, Mr. Dugald Clerk, the eminent gas-engine expert, practically proved, that with our present knowledge of materials and the laws of science, the gas turbine is impossible. Here are his conclusions and advice:

Compared with cylinder expansion, I cannot see how it is possible, with present knowledge to obtain an efficiency of conversion in a gas turbine greater than 80 per cent.

In my view, no efficiencies of compression or jet expansion are at present known which will give an engine even 22 per cent. practical efficiency, and accordingly there appears no likelihood of the production of any gas turbine which can rival the reciprocating gas engine in efficiency and in economy. To produce such a turbine requires the solution of three problems:—(1) An efficient turbine compressor comparable in efficiency with cylinder compression. (2) An efficient nozzle expander with a higher efficiency than 90 per cent. (3) An efficiency of conversion of kinetic energy of the moving gases into work delivered at the turbine spindle, of greater than 80 per cent. Either these problems must be satisfactorily solved, or else new materials discovered which will stand temperatures which at present melt fire-brick. The outlook, I fear, is not hopeful.

I am the last man in the world to deprecate daring in any practical and scientific work, but I would advise the junior Engineers—members of our Institution—to avoid the subject except as a scientific study. I fear there is little hope for a young man to make a position and a business success of any internal combustion turbine, as far as our present knowledge carries us.

It is quite evident that the search, for the time being, is out of the hands of the Mechanical Engineer. The solution of the gas turbine problem rests with the *Metallurgist*.

Steam Engine of The Future.

There is cumulative evidence enough to convince the most sceptical, that the motive engine of the future will be one in which the utilization of the force of fluids—elastic and inelastic—will be mainly by rotary impulse instead of reciprocatory pressure.

The advocates of the impulse engine claim, that in the matter of steam economy, the turbine equals the record of the best reciprocating engines; while in the matter of first cost, maintenance and saving of space—for high powers, the evidence before the engineering world indicates that the impulse engine is incomparably superior.

Although the Parsons "pressure turbine" is more in the popular view just now, there is a lurking suspicion in the minds of not a few well informed Engineers, that the "velocity turbine," of which the De Laval engine may be taken as a type, is likely to prove the more economical and efficient form of impulse engine: especially for low powers. In our January number we purpose describing and illustrating the latest development of the De Laval turbine steam engine.

Exploiting Europe

Every Engineer in Canada interested in the development of the water power and mineral resources of the Dominion, will be glad to know that Mr. Charles H. Mitchell, B.A.Sc., C.E. (Tor. Univ.), A.M., Can. Soc. C.E., late Hydraulic Engineer to the Ontario Power Co., Niagara Falls, sails for Europe on December 16th, equipped with camera, intending to investigate water-power developments in Italy, France, England, Germany, Switzerland, etc., and will contribute to our columns a series of exclusive articles, descriptive of the famous hydraulic systems in these countries. We wish Mr. Mitchell *bon voyage*, and a pleasant and profitable visit to these beauty spots in the Old World.

Our Programme Approved

Among the congratulations which are coming to our desk from all quarters, is one from Dr. Eugene Haanel, Government Superintendent of Mines. He says:

I am glad that we are to have a journal in Canada which will be devoted to the interests of the metallurgical development of Canada.

This cheery word (November 22nd, 1905) is accompanied by the following communication, which will be of special interest to our readers:

Regarding the experiments at Sault Ste. Marie, I may say that we will be ready in about three weeks to turn on the current. The furnace has a capacity of two tons of pig iron per 24 hours, and is capable of absorbing 300 E. H. P. The electric measuring instruments, comprising voltmeter, ammeter, wattmeter and power meter, were designed and constructed by the Westinghouse Company, Pittsburgh, Pa., as were also the transformer needed to transform the available current at 2,200 volts down to 55 volts. The cables used are of aluminium.

(By permission of "Collier's" Weekly, New York).

THE AGITATOR.

"Who is it's brought us here I ask? Who's a-grindin us under the iron heel o' despotism? I say to you, the time has come when.....!"

DRAWN BY CHARLES DANA GIBSON.

It is a fact that a working man has greater privileges to-day than a king had one hundred years ago! At small cost he may read the world's best literature, hear the grandest music, witness the noblest dramas and say with truth:

"My Minde to me a Kingdom is."

Looking out of himself, he may exclaim: "At this moment, ships are plowing the ocean to bring me things from all parts of the world. In China and Ceylon men are gathering tea leaves for me. In the Southern States of America they are planting cotton for me. In the West Indies and Brazil they are preparing sugar and coffee; in Italy, feeding the silk worms; in far Australia they are shearing sheep to make me fine woolen clothing. Powerful engines are driving machines for spinning and weaving silks and laces, making fine cutlery, or pumping the mines, that minerals and metals useful to me, may be procured. It is true my patrimony is small, but nevertheless, I have locomotives running day and night on all railroads, to carry my correspondence; canals on which to bring coal for the winter's fire; telephone stations, that I may communicate by voice with my friends everywhere; telegraph lines to tell me what is happening thousands of miles away, or flash a message to some sick one across the seas; while editors and printers work day and night in order that I may have my newspaper at breakfast, to tell me what is happening in all parts of the earth."

"FIRING OUT THE FOOLS."

By Dr. Robertson Nicholl, Editor "The British Weekly."

In every business establishment there are many who are not worth their wages. Either they were never efficient, or they have ceased to be efficient. This is so all over the world. It is the case even in the United States. I read the other day a bright little article in an American paper in which the writer spoke of youths who despised their business, youths who took no pains to master it, who were always anxious for a half-holiday or a whole holiday, youths who were clever in games and learned in sport, but stupid and incapable in the task they were set to do. The writer said very properly that these had to be got rid of, and that as soon as possible. There are also, as everybody knows, men who are efficient when young, but who have grown easy and comfortable, and much attached to bygone ways. They are always to be found amongst the champions of reaction. When the firm with which they are connected strikes out in some new enterprise, they shake their heads. They not only fail to help it on to success, but they are a drag upon it. If it fails, they say, "I told you so," or, what is even more irritating, perhaps the most irritating phrase in the world, "I always thought so." You never dream of communicating to them any new idea. Ignorant of the fact that it is only by new and sound ideas, properly carried out, that business can live or thrive, they have made up their minds before they hear the proposal that the proposal is bound to collapse. If, in spite of them, any new project is made to succeed, they say as little about it as they conveniently can. Yet they are respectable men in their way, keep their hours, do their work in a decent sort of way, are eminently well pleased with themselves, and would imagine that they were wronged exceedingly if they were fired out. In fact, they calculate upon being kept in the business as long as they can work, and then being dismissed with good pensions. It seems hard to fire them out, and yet in the end it might be the best thing for them. If every man was made to know that he held his position simply so long as he filled it efficiently there would be a great quickening everywhere. As it is, many men become duffers at forty. And there is too much to be said for the idea that youth is the qualification for success. But, as a matter of fact, it is not so. It is of no importance whether a man's hair is white or black, whether he was born in the fifties or the sixties or the seventies. What is important is that he should be efficient. If a man keeps up to the mark of the time, never allowing himself to fall asleep or to become comatose, he ought to grow a better man with the years, for he has the experience of the old and the alertness and readiness of the young. As it is nowadays, so many elderly people have nothing but experience, that they are quite useless; for experience after all, can only do a little,

and that little depends on its being wisely used. Experienced men are apt to apply their experience to the conditions under which they are gained. But now that the conditions have all altered, this is plainly fallacious and destroying. The new conditions must be recognized, and then it will be seen that what would have been successful under old conditions will now prove an entire failure. We have plenty of room for old men like Earl Roberts, and he is the only one. Still, the chance of the old is to associate themselves with the young. The caution and experience of age, joined to the enterprise and audacity of youth, are the conditions of success. It is long ago since one of the first men of the city of London said to me that he regarded no firm as safe if the partners were all over forty years of age, and I fully believe he was right. By the end of this century there will be no such thing as appointments for life. People will keep their places just as long as they deserve to keep them, and not a minute longer. As things are, we have every kind of abuse. We have in our colleges professors who teach nothing, who have no influence over their students, and who live to abnormal ages simply because they have never known what it is to work. And so, as I said, we have in almost every business establishment men who exist in the business for no useful end; who draw their money, but fail to do their duty.

The next item of the American advice is equally sound, and follows upon the other. "Pay good men handsomely." If you fire out the fools you can afford to do this, for a good man in the business is worth an incompetent man many times over. For one thing, he can do much more work. He will avail himself of all the labor-saving appliances with which modern science has furnished us. It is a mistake to suppose that discoveries lessen labor. They come just when the pressure of work is growing intolerable, and make work possible. For example the system of typewriting did not arrive a moment too soon. Business men were becoming crushed with the weight of their correspondence. The use of typewriting is practically a test of an up-to-date firm. If a man comes down to his business and laboriously writes his letters, he can practically do nothing else. He could save one half the time by dictating them to an expert typist, and then the other half of his time would be given to other work, and things would move forward. In the same way there are editors, or used to be editors, who practically knew nothing of what their rivals were doing. They could not be troubled. They fancied that they knew their business, and that everything was right. For such people there are rude and strange awakenings, and there will be more of them in the future. I knew a journalist who went to a certain city to be the first editor of an evening newspaper. A rival had planted itself pretty firmly. This man not only did his work as well as he could, but, when the work is over, took a blue pencil, spread out his own sheet and found out what was common to each, what was distinctive in each, what were the strong points of his rival, and what were his own weak points. He set himself to developing his own features and to meeting his competitor on the points where it excelled him. This meant very hard work, but it meant success. Even one man of great talent and unwearied diligence and devotion will make a mighty difference to a business, will alter its outlook, and will to a certain extent carry a large body of dull and vacant men upon his shoulders. But it is possible to crush him. Even in these days, a firm where every partner was thoroughly efficient and where every one of the principal workers was also thoroughly efficient, would carry all before it.

NEW BOOKS RECEIVED.

Molesworth's Pocket Book of Engineering Formulae. By Sir Guilford L. Molesworth, K. C. I. E., President of the Institution of Civil Engineers; member of the Institution of Mechanical Engineers; Fellow of the University of Calcutta, and Henry Bridges Molesworth, member of the Institution of Civil Engineers. London: E. & F. N. Spon, Limited; New York: Spon & Chamberlain. Size 5" x 3¼". 850 pp. (Price 6s.).

Mechanical Engineering. By Charles M. Sames, B. Sc., M. E. A pocket book of mechanical engineering, tables data, formulæ, theory, and examples. Jersey City, N. J.: Charles M. Sames. Size 4" x 6¾". 168 pp. (Price $1.50).

From Technical Publishing Co., Limited, London and Manchester.

The "Practical Engineer" Electric Pocket Book, 1906. Containing the latest available data, and formulæ used in electrical engineering. Size 5½" x 3½". 440 pp. (Price 1s. 6d., net.).

The "Practical Engineer" Pocket Book, 1906. Containing the latest data on mechanical engineering. Size 5½" x 3½". 598 pp. (Price 1s. 6d., net.).

Archibald Constable & Co., Limited, London.

British Progress in Pumps and Pumping Engines. By Philip R. Bjorling, Consulting Engineer. Size 7¼" x 10½". 70 pp. (Price 6s. net.).

British Progress in Gas Works Plant and Machinery. By C. E. Brackenbury, A. M. Inst., C. E., member of the Institution of Gas Engineers. Size 7¼" x 10½". 105 pp. (Price 6s., net).

Gems and Gem Minerals. By Oliver C. Farrington, Ph.D., Curator of Geology, Field Columbian Museum. Chicago: A. W. Mumford. Size 8¼" x 11¼". 229 pp. (Price $3.00.).

Secrets of the Rocks. A story of the hills and gulches. A manual of hints and helps for the Prospector and Miner. By S. M. Frazier. San Francisco: Mining and Engineering Review. Size 5¾" x 8". 432 pages. (Price $1.60.)

Mexican and Central American Antipuities, Calendar Systems, and History. Translated by Charles P. Bowditch. Washington: Bureau of American Ethnology, W. H. Holmes, chief. Size 6" x 9½". 682 pp.

Elementary Practical Metallurgy: Iron and Steel. By Percy Longmuir, Carnegie Research Scholar and Medallist Iron and Steel Institute. London, E. C. Longmans, Green and Co., 39 Paternoster Row (1905). Size 7½" x 5¼". pp. 269. (Price 5s., net.).

CATALOGUES AND CIRCULARS.

Technical Books.—Spon & Chamberlain, New York, have just issued a full descriptive catalogue of technical books (200 pages), covering all branches of Engineering. See list of some new works in review column.

Monthly Publications.—"The Fairbanks Standard;" published in the interests of The Canadian Fairbanks Co., Limited, Montreal, Toronto, Vancouver. and Winnipeg. This paper describes each month the new line of manufactures, and specialties, which this enterprising company are continually putting on the market, 6 x 8¾, pp. 16.

"Cementology:" published by The Whitehall Portland Cement Company, Philadelphia, Pa., U.S.A. The pamphlet is full of valuable information to users of concrete. 3¼ x 6¼, pp. 8.

"Nernst Electric Lamps."—The various purposes to which this popular lamp can be put are described and illustrated in "The Nernst Central Station Bulletin," published by The Nernst Lamp Company, Pittsburgh, Pa., U.S.A. 7¾ x 10¼, pp. 4.

"Atlas" Car Movers.—W. H. C. Mussen & Co., 763-765 Craig Street, Montreal, have issued a circular giving prices of their special car moving appliance, and containing numerous testimonials as to its utility. 6 x 3½, pp. 4.

Mechanical Machinists' Tools.—Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A., have just issued an elaborately illustrated catalogue, showing their unique line of fine machinists' tools. It will pay every machinist to get a copy. Write them. 6 x 9, pp. 164.

Electrical Rotary Converters.—Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., U.S.A. The design and construction, together with instructions for the erection, operation, and care of their rotary converters, are given in an instructive and interesting catalogue. 6 x 9, pp. 67.

Engineer's Report: City of Halifax.—We have just received the City Engineer's (F. W. W. Doane), report of Halifax, N.S., for the civic year 1904-05. 5½ x 8½, pp. 96.

Electric Drills.—Chicago Pneumatic Tool Company, 95 Liberty Street, New York, U.S.A. Air Cooled Duntley Electric Drills are fully set forth in special circular No. 52, issued by this company. 9 x 6, pp. 8.

Water Purifiers.—The Paterson Engineering Company, Limited, Amberley House, Norfolk Street, Strand; London, W.C., England. This company specializes in apparatus for obtaining pure soft water for steam raising and industrial purposes. The special advantage of their purifiers is given excellent publicity in leaflet "X." 8½ x 10½, pp. 4.

Pipe Stocks and Dies.—The Armstrong Manufacturing Company, Bridgeport, Conn., U.S.A., have sent us four small circulars, of various colors, giving prices of their well known line of pipe cutting and threading tools. 3 x 6.

The Buyer's Reference.—The "Electrical Edition" of this valuable publication has just come to hand. It gives the buyer of electrical appliances, names of those who make what he wants. Published by The Buyer's Reference Co., Incorporated, 123 Liberty St., New York, U.S.A. 8¼ x 9, pp. 138.

Railway Electric Apparatus.—Canadian Westinghouse Electric and Manufacturing Company, Hamilton, Ont. A handsomely illustrated catalogue, descriptive of D. C. railway motors; single-phase alternating current motors; generators, single-phase electric locomotives, system of control, etc. 6¼ x 9¼, pp. 20.

Electric Mine Locomotives.—The Jeffrey Manufacturing Company, Columbus, Ohio, U.S.A., Bulletin No. 10. This is one of the finest examples of art, as applied to trade advertisement, that we have seen. The book is devoted to setting forth graphically, electric mining machinery; particularly electric, "gathering," jack rail, and storage battery locomotives. 7¾ x 10, pp. 68.

Cranes: Iron and Steel Works Equipment.—Cranes, for use in the various departments of iron and steel works, are detailed by means of fine engravings and descriptive writing in an admirable catalogue issued by the Wellman-Seaver-Morgan Company, Cleveland, Ohio, U.S.A. 9 x 12, pp. 30.

Electric Switches.—Canadian Westinghouse Company, Limited, Hamilton, Ont. Type "G" enclosed switch, suitable for severe service in the hands of unskilled labor, is well brought out in circular No. 1,121. 7 x 10, pp. 4.

Mechanical Draft.—Bulletin No. 75, entitled, "Mechanical Draft; What it is, What it Does," has just been issued by B. F. Sturtevant Company of Boston, Mass., U.S.A. This booklet briefly presents the salient features of their system of draft production. 3½ x 6½, pp. 12.

Tool Steel, Small Tools, Saws, etc.—Hobson, Houghton & Company, Ltd., Don Steel Works, Sheffield, England. Tool steel, drills, reamers, hammers, saws, etc., are shown together with price lists in a fine catalogue issued by the above company. 8¾ x 10¾, pp. 42.

Page's Weekly.—A comprehensive weekly review of Engineering, electricity, shipbuilding, mining, and the iron and steel industries of the world; illustrated. 8 x 10¾, pp. 56.—(Editorial).

Prepayment Wattmeters.—Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., U.S.A. These wattmeters are well described and illustrated in circular No. 1,123. 7 x 10, pp. 8.

Edgers.—The Wm. Hamilton Manufacturing Company, Limited, Peterborough, Ont. The edgers which are lucidly explained, and shown by cuts, in this catalogue, are suitable for lumber mills of any size. 6 x 9, pp. 12.

Lifting Jacks.—A. O. Norton, Coaticook, Que., sends us a pamphlet showing his ball-bearing jacks, from a 15-ton journal jack, to a 60-ton car jack. 3¼ x 5½, pp. 2.

The Use of Gas for Power and Heating.—This is the title of a very comprehensive paper read by Ernest A. Dowson, A.M.I., Mech. E., M.J. Inst. E., before the Birmingham Association of Mechanical Engineers, Thursday, April 27th, 1905. E. A. Dowson is a past-master in the science of gas production for power purposes. The data in this paper are invaluable to owners of existing and contemplated gas producer plants. 5½ x 8½, pp. 82.

Ratchet Drills.—The Billings & Spencer Co., Hartford, Conn., U.S.A. A price list has just been published by the above company, descriptive of their packer ratchet drills. 3½ x 6½, pp. 8.

Motor Cars for Railroad Work.—Fairbanks, Morse & Co., Chicago, Ill., U.S.A. In catalogue No. 101 A, Sheffield gasoline motor cars, for railroad inspection, are presented. These cars obviate the expense of running a locomotive over the line, and are more easily handled. They are simple and practical in construction, strong and durable, and all parts are easily accessible. The illustrations show clearly the various models. 6 x 9, pp. 16.

Non-condensing Steam Engines.—The Westinghouse Machine Company, East Pittsburgh, have issued a handsome pamphlet, setting forth the advantages of their simple, non-condensing, standard type of reciprocating steam engine; known throughout the industrial world for over a quarter of a century, on account of its peculiar, inclosed construction. Nearly 6,000 of these engines have been sold, and by the careful correction of defects developed in service, and wise economy in mechanical details, this standard engine has now almost reached the ideal stage. Buyers and Engineering students alike will find the finely illustrated catalogue before us. well worth perusing. 6 x 9, pp. 351.

Locks and Hardware.—Yale & Towne Manufacturing Co., New York, N.Y., U.S.A., Catalogue No. 18, "Handy Edition." This volume contains a selection from their complete line of hardware products, of the most popular locks, in sizes, saleable by retail hardware dealers. 6 x 9, pp. 206.

Economizers.—B. F. Sturtevant Co., Hyde Park, Mass., U.S.A. The advantages, construction, repairing, installation and manipulation of Sturtevant economizers, together with figures showing the saving to be effected by their use, are given in their catalogue No. 120. 6½ x 9, pp. 45.

Lifting Magnets.—The Electric Controller & Supply Company, Cleveland, Ohio, U.S.A. These magnets are used in the handling of pig-iron, light and heavy melting scrap, steel ingots, blooms, billets, slabs, plates, sheets, rails, structural shapes, spikes, rivets, cotter pins, etc. The best resources of the photographers' art have been requisitioned to illustrate the diverse applications of the magnet to the handling of material in the great iron and steel industries. 6 x 9, pp. 24.

ENGINEERING SOCIETIES

Canadian Society of Civil Engineers.—President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod, rooms, 877 Dorchester St., Montreal.

Canadian Mining Institute.—President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Land, Victoria, B.C.; treasurer, J. Stevenson Brown, Montreal.

Engineers' Society, S.P.S.—President, J. P. Charlebois; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirriss.

Engineers' Club of Toronto.—President, R. F. Tate; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms; King St. West, Toronto.

Canadian Railway Club.—President, S. King, Montreal; secretary, James Powell, Montreal; treasurer, S. S. Underwood, Montreal.

Marine Engineers.—Grand President, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N.B.

Canadian Association of Stationary Engineers.—President, W. A. Sweet; vice-president, Joseph Ironside, Hamilton; secretary, D. Outhwaite, Toronto; treasurer, A. M. Dixon, Toronto.

Toronto Branch American Institute of Electrical Engineers.—Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

Canadian Electrical Association.—President, A. A. Wright; first vice-president, R. G. Black; second vice-president, John Murphy; secretary-treasurer, C. H. Mortimer.

American Society of Mechanical Engineers.—Fifty-second meeting will be held in New York, December 5th to 8th, 1905.

CANADIAN ASSOCIATION STATIONARY ENGINEERS.

Toronto, No. 1.

The first monthly lecture of the Canadian Association Stationary Engineers, Toronto, No. 1, was held on Wednesday evening, November 15th, in Engineers' Hall, Toronto. The lecture, entitled, "Coal, Combustion, Cost for Power," was given by M. C. Huyette, of the Murphy Automatic Smokeless Furnace.

About sixty members and their friends were present, and it was apparent from the attention given the lecturer, that they enjoyed his very instructive talk.

Mr. Huyette dealt very comprehensively with his subject, which was illustrated by lime-light views, one of which is shown above. This shows the stacks leading from nine boilers; the six on the left of the picture are fitted with the Murphy Automatic Smokeless Furnace, and the three on the right are hand-fired. As will be noticed, the latter series (hand-fired) are belching forth dense clouds of black smoke,

although the boilers were only working at their normal rated capacity, while from the others, hardly any smoke can be noticed; and there would not have been any, had it not been for the fact that at the time the photo was taken the boilers were being operated at sixty per cent. above their rated capacity. Even under these conditions, a saving in fuel of 26 per cent. was made.

Before these boilers were fitted with the Murphy Furnace, nine men were required to do the firing, now only three men are employed for this work, and the efficiency of the boilers has been increased 40 per cent.

Since the photo was taken the three hand-fired boilers have been fitted with Murphy furnaces.

On Wednesday, December 20th, Mr. James Milne, of the Jones Underfeed Stoker, will lecture before the Association.

P. W. B.

ENGINEERS' CLUB OF TORONTO.

November Sessions.

(Reported by our special correspondent: P. W. B.)

At the meeting held on Thursday evening, November 9th, under the presidency of R. F. Tate, it was resolved to establish a weekly luncheon in connection with the Club, in order to cultivate a better social and fraternal spirit between the members. It was also decided to install a telephone in the club room with a view of inducing the members to use the reading-room more frequently.

The following applicants were admitted to membership:—T. Craig Irving, Jr.; A. A. Bowman; Louis J. Street; W. Robt. Worthington; M. A. Stuart, and C. R. Young.

The event of the evening was an address by Frederick A. Knapp, B.C.L., of Prescott, Ont, explaining the principle of his celebrated marine roller boat, illustrated on the next page, as it appeared in Toronto Bay, October 27th, 1897, on a preliminary trial. Inasmuch as Mr. Knapp is not a trained Engineer, but a barrister, with some original ideas in mechanics, it seemed like an act of temerity to appear before such past-masters in the science of Engineering as formed his audience; but with serene manner, and perfect confidence in his project, he set forth the claims for his boat, explained away the causes of apparent failure in the past, and propounded heterodox views on skin friction, wind pressures, and horse-power formula, in a way that even the most skeptical listener was bound to admire.

In the first place, he maintained that instead of the famous trial in Toronto Bay, in the presence of thousands of Toronto citizens, being a "fiasco," it demonstrated the principle of his invention; for the boat rolled at the rate of 6 miles per hour. The failure consisted in not rolling at a hair-raising speed of one mile per minute. If there was any failure at all, it was due to the method by which the vessel was propelled. This consisted of two locomotives—one at each end—running on circular tracks, and they rolled the boat forward by climbing up inside just as a squirrel spins the wheel of his cage by mad attempts to ascend the bars of the circular prison. Mr. Knapp alleged that he was never in sympathy with this scheme of obtaining speed by gravity; but submitted to the judgment of the Engineers who co-operated with him in the construction. His own plan was, and is, a combination of leverage and gravity, by suspending his operating engines in the middle of the boat from a longitudinal shaft, supported on special bearings at the extreme ends. This scheme was declared by responsible Engineers to be impossible; he was told that it would be lifting himself by his bootstraps. But this objection has been completely falsified; for in the trials made recently across the St Lawrence at Prescott, with his latest model, he had demonstrated its perfect practicability; and had attained by the lever and gravity method of propulsion, a speed of nine miles per hour. The descriptive part of the address was followed by interesting reminiscences of discussions with Engineers of distinction, relative to accepted views on skin friction, momentum and wind pressures. But since neither formula, nor scientific data were adduced in support of the somewhat heterodox opinions enunciated; only pure assertion in the *tu quoque* style of argumentation, we are unable to reproduce. In one respect, Mr. Knapp's almost contemptuous attitude towards the academic side of Engineering can be readily understood. He was told that his boat would not roll; it did roll. He was told that his vessel could not be driven by a suspended motor; he claims to have demonstrated that it can.

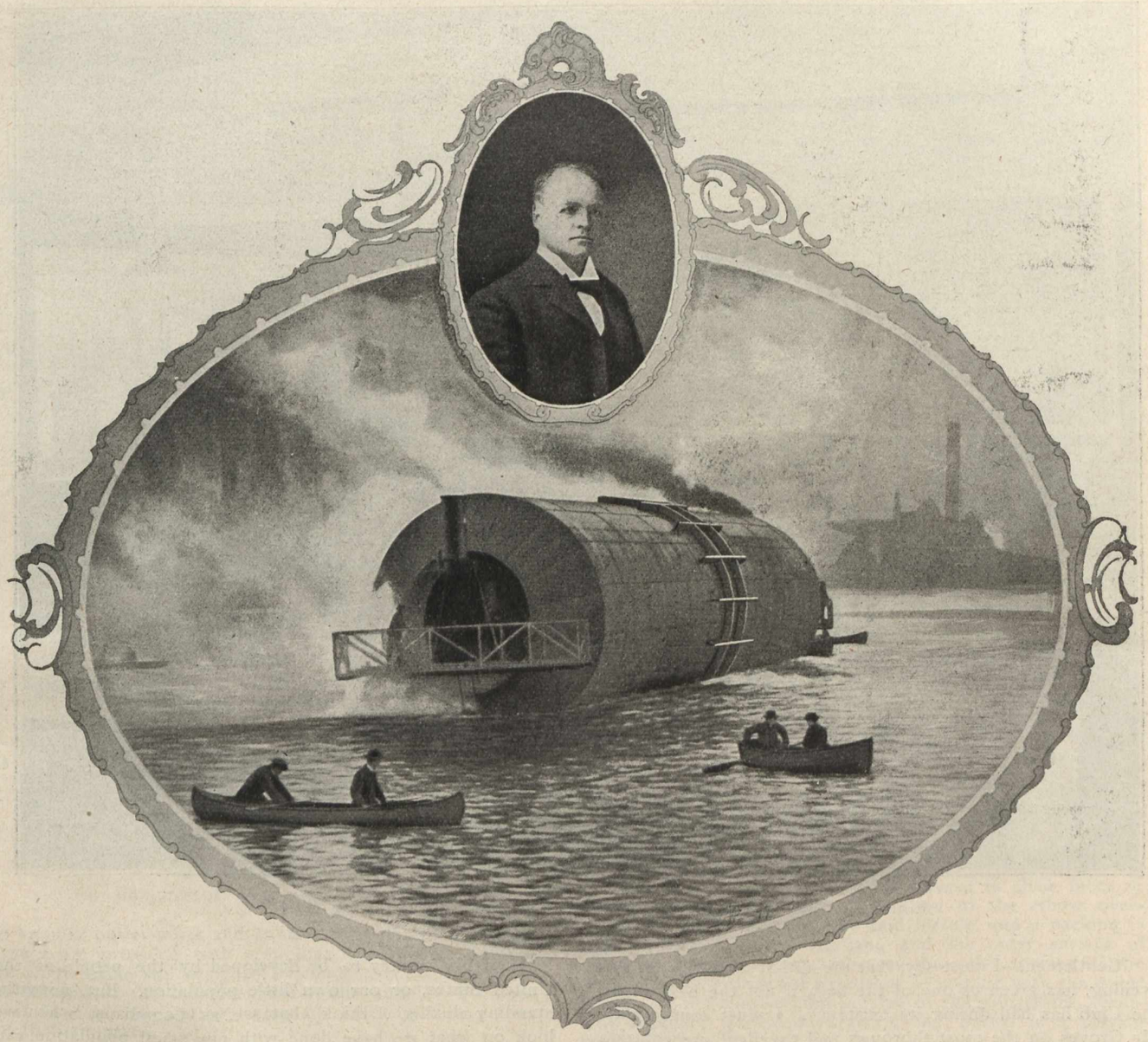
Based upon these initial successes, Mr. Knapp announced his intention of pushing forward with his scheme. He somewhat startled his auditors by declaring his purpose to have a roller boat built by which we can cross the Atlantic in ten hours; breakfast on this side of the water, and taking tea the same day in the Motherland. Drawings were exhibited showing a cylindrical ship 200 feet diameter, by 800 feet long, with the propelling machinery suspended by levers, so that the weight behind the stroke of the engines, would be greatly multiplied; since it would be considerably greater than the actual dead load of the engine. This large cylinder would be fitted with paddles about five inches deep, viz.: five-inch steel angles running the whole length. In order to attain the speed afore mentioned, it would only be necessary for the outside shell to turn at the rate of twenty-five revolutions per minute.

In the discussion which followed the reading of the paper, the question of bearings on which this cylinder would revolve, was raised. The objection was made that bearings could not be obtained which would withstand the load, and wear and tear involved. In reply to this, the fact was cited, that steam turbine bearings under forced pressure of oil had been known to run seven years without showing any appreciable wear. In propelling a vessel of these large dimensions, wind pressure is one of the difficulties which presents itself to the mind of the trained Engineer; Mr. Knapp claims, that as his boat will roll into the wind in-

stead of pushing dead against it, wind will not retard the speed.

When asked about the steering of this immense vessel, Mr. Knapp stated that his experience with the 110-foot boat, had given him reason to believe that this would not be a difficult matter as he had been able to steer it quite successfully from Toronto Bay down the St. Lawrence to Prescott, Ont., a distance of over 200 miles, by means of a rudder at each end, which retarded the forward movement of one end, allowing the other to swing round.

In the socratic discussion which followed Mr. Knapp's address on this somewhat novel theme, the objections raised to his scheme were very few. This was remarkable, in view of the fact that many experienced Engineers of high standing were present.



At the present time Mr. Knapp is engaged on the design and construction of a tubular boat at the ship yards of the Canadian Shipbuilding Company, Toronto, which it is understood, will be ready for trial and operation in the spring of 1906. It is fully expected that this new type of boat will revolutionize the coal trade between Nova Scotia and Ontario.

Second Meeting.

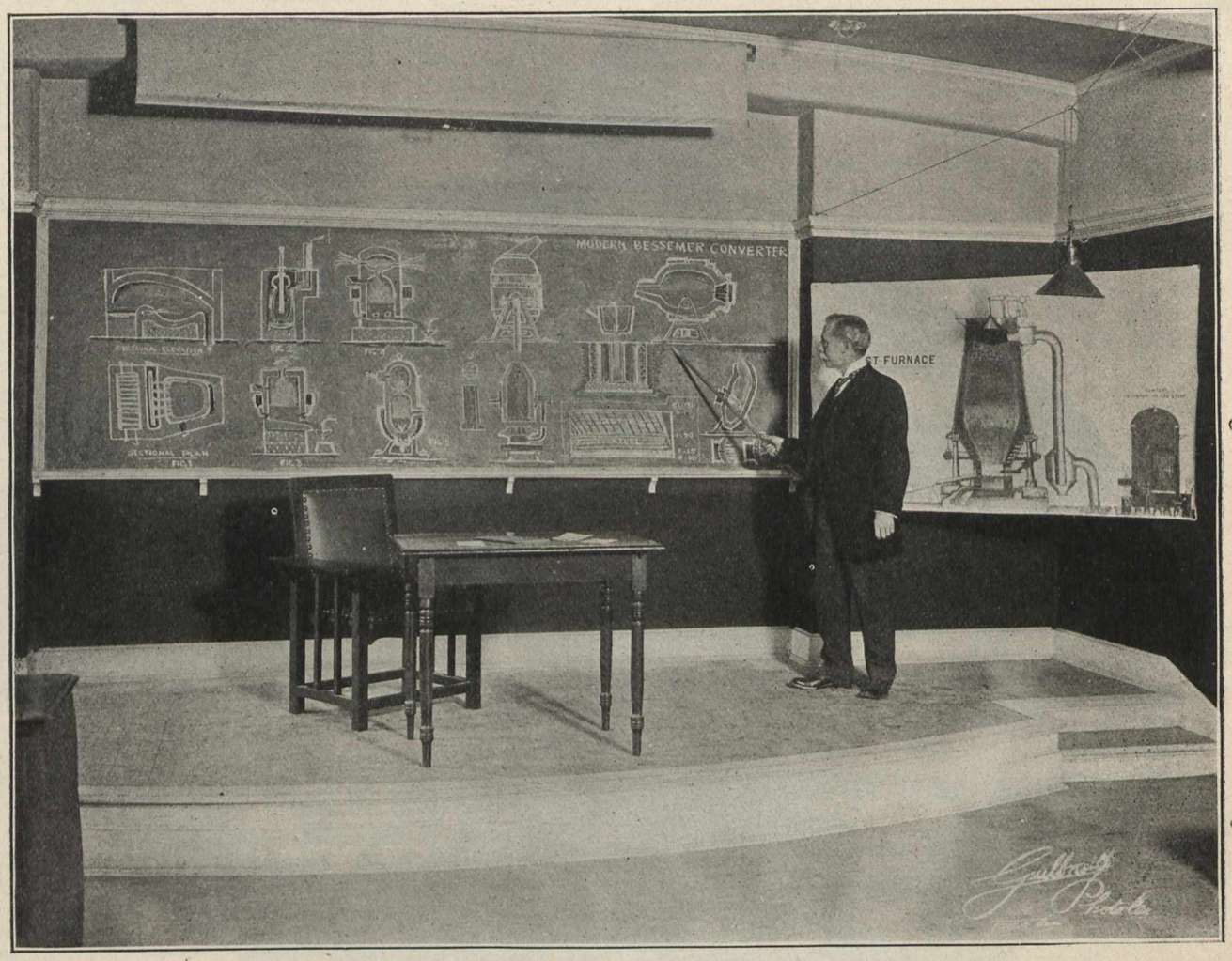
The second fortnightly meeting was held on the 23rd ult., with President R. F. Tate, again in the chair. There was a goodly attendance to listen to an illustrated lecture, entitled "Historical Sketch and Description of the Bessemer Steel-making Process," by S. Groves, Editor of "The Canadian Engineer," 1904 Lecturer on "Mines, Furnace and Foundry" to the Carnegie Technical Schools, Pittsburgh.

After a brief general description of the only methods of steel-making in existence prior to 1855, viz.: The crucible: cast steel; and cementation: shear steel, processes; followed by a graphic word picture of the "Bessemer" open hearth, and "Tropenas" methods in vogue to-day; the first of which consists of blowing cold air into hot metal, the second of hot gases playing on cold metal, and the third of cold air blown on top of hot metal, the lecturer told the interesting story of the evolution of the converter, or Bessemer system. This process—invented in 1855—was originally based on the theory that complete purification of pig iron could be effected by oxidation. But "time which treadeth down all things but truth," had falsified this belief; for it had been established by rigid experiment and extensive practice, that neither by exposing heated pig iron to an oxidizing flame as in the open-hearth furnace, nor by blowing air through the bath as in the Bessemer Converter, can sulphur and phosphorus be eliminated. The puddling furnace invented by Cort, 1784, and the basic process invented by Thomas and Gilchrist, 1878, are the only successful methods so far; the former by a process of mechanical washing, and the latter by elective chemical affinity. With the aid of diagrams in colored chalk, the *modus operandi* of making Bessemer steel was lucidly explained; (1) pouring of hot metal from the blast furnace into the converter; (2) injection of cold blast at 25 lbs. per square inch into the molten metal through the ⅜-inch tuyeres in bottom; (3) chemical re-actions, involved in the elimination of the silicon, manganese and carbon from the bath, by the chemical combination of these metalloids with oxygen injected in the blast; and (4) final introduction of additions after the 15 or

20 minutes "blow," in the form of spiegeleison, or ferro-manganese, to give the requisite carbon contents to the steel.

A reference to the Governmental experiments with the electric furnace, to commence at Sault Ste. Marie, three weeks hence, under the supervision of Dr. Eugene Haanel, and which the speaker predicted would prove a commercial success; and an optimistic survey of the future of Canada as a steel-producing country, brought the lecture to a close.

The following is a report of the president's comment:—



Editor of "The Canadian Engineer" at the Engineers' Club of Toronto.

Gentlemen,—I must say, that the author of the paper this evening, has given us one of the best, if not the best paper, the Club has had during its existence. I must congratulate Mr. Groves on the most thorough and excellent presentation of this subject. The practical manner in which he has placed the steel-making process before us is such, that I am sure, everyone here has been deeply interested. He has gone into the matter so thoroughly, and explained everything so minutely that it leaves nothing to add. I am sure it must be a revelation to many of us, and a source of pleasure and profit to learn the position that Canada is in with regard to future development in iron and steel, I have, no doubt, that a great deal of what Mr. Groves has said will be realized. Of course, we have the great enterprises of the United States that are irrepressible. The Americans will come into this country, invest their money, and, no doubt, Canada will receive the benefit of their enterprise. If Great Britain is not as enterprising, it is her loss. I may say as a Canadian of some years' standing, that I have been almost disgusted with the capitalists of Great Britain, in leaving this country to be developed by the people of the United States, or our own little population. But, notwithstanding all this, I think that we, as Canadians, when we look on what we have done with our small population can stand out before the world and feel that no nation on earth has done better, or even equalled the accomplishments of the Dominion of Canada and her people.

A hearty vote of thanks to Mr. Groves, moved by T. S. Scott, seconded by A. M. Wickens, was carried by acclamation, and the proceedings terminated.

THE ART OF ADVERTISING.

By RAYMOND BLATHWAYT.

Nineteen years ago Mr. W. S. Gilbert thus delivered himself concerning the necessity for perpetual advertisement:—

> If you wish in the world to advance,
> Your merits you are bound to enhance,
> You must stir it and stump it
> And blow your own trumpet,
> Or, trust me, you haven't a chance.

And these words, however, much we may dislike the facts they proclaim, however much we may decry the necessity for advertisement and bewail a decadent age, these words are even truer to-day than they were when they were first declaimed in the autumn of 1886.

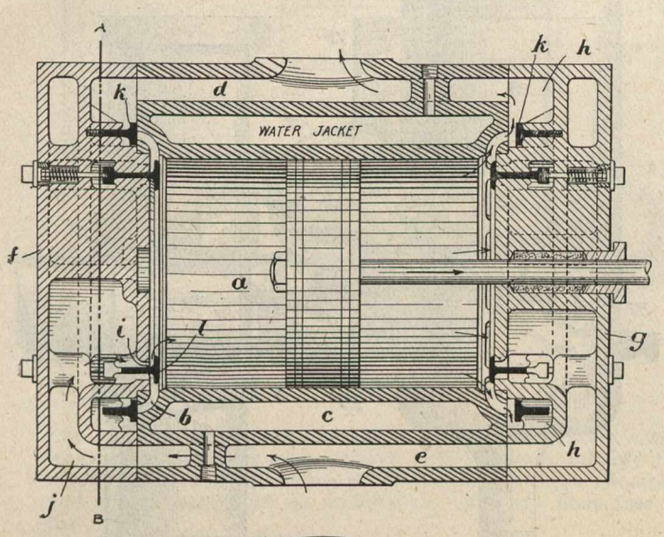
The world is so vast now, and people are in such a hurry, the struggle for bare existence is so tremendous that unless a man pushes himself or his wares vigorously to the front he has not a chance of winning his way to the top. I am bound to own that advertisement is an absolute necessity. Silent merit has no chance nowadays; you must make it known to the world as speedily as frequently, and as loudly as possible. And if the merit is about the average, and if the goods you offer are really worth the world's buying, and you adopt legitimate and honest methods of making them known and of attracting attention to them, then I do not think that advertising can fairly or honestly be decried as though it were something mean and shameful.

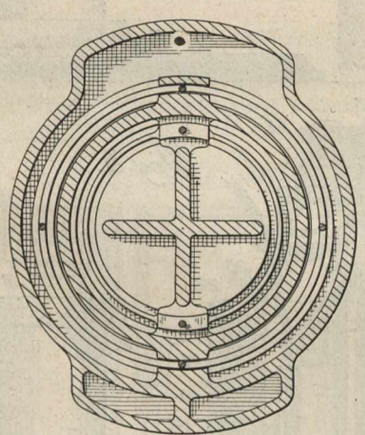
INTERNATIONAL PATENT RECORD

CANADA.

Specially compiled by **Messrs. Fetherstonhaugh and Dennison**, Patent Attorneys, Toronto, Montreal, and Ottawa.

Air Compressor.—A. J. Lavoie.—93,013.—The arrangement is that of an open ended cylinder *a* having annularly arranged outlet ports *b*, and a water-jacket *c* surrounding said cylinder and air passages *d* and *e* above and below said water jacket, heads *f* and *g* having passages *h* communicating with said outlet ports *g*, and the air passage *d* of the cylinder, and an annular inlet port *i* and a passage *j* leading therefrom to the air passage *e* of the cylinder. T-shaped annular valves *k* and *l* arranged to close

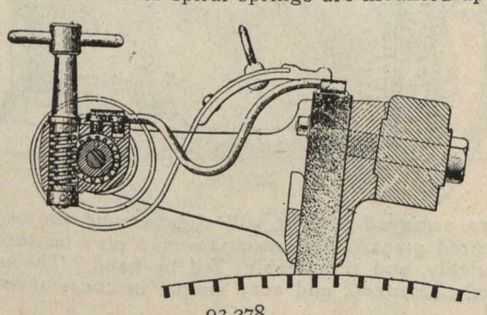




Air Compressor, 93,013.—A. J. Lavoie.

said annular outlet ports and annular inlet ports. The inlet valves *l* are provided with stop lugs forming an integral part of the same and designed to come in contact with the lugs formed in the cylinder head. The annular T-shaped valves have suitable spring means for assisting them to return to their seats.

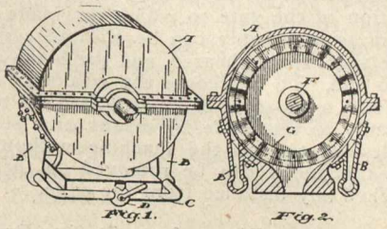
Brush Holder for Electrical Machine.—The Canadian Westinghouse Co., Hamilton.—93,278.—In this patent a new form of brush holder is shown in which there is a shaft upon which the holder is loosely mounted. A series of spiral springs are mounted upon said

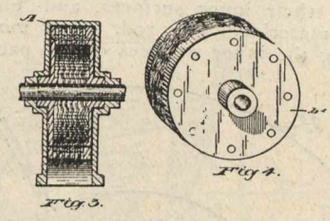


93,278.

shaft and bear at their outer ends on the carbon brushes. Each of the spiral springs has a worm gear mounted upon the brush to which the spring is attached, and these worm gears are operated by small worms located in the frame of the holder.

Steam Turbine.—J. H. K. McCollum.—93,419.—This invention comprises a new form of steam turbine which is readily reversible. *A* is a cylindrical casing which is provided at either side with nozzles *B*. The nozzles *B* are connected together by a pipe *C* in which is located a

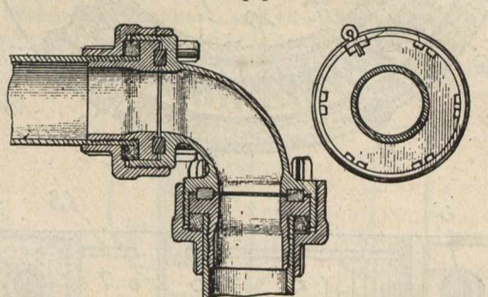




93,419.

three-way valve *D* for reversing and exhausting. Mounted within the casing *A* upon the shaft *F* is a drum D^1, the periphery of which is formed with a series of serpentine passage ways.

Swivel Coupling.—A. J. Hageman.—92,880.—This invention relates to pipe couplings which are required to be swung in various directions, and allows both of the pipes and the swivel to be turned. A ferrule is screwed into the end of the pipe and the elbow connection



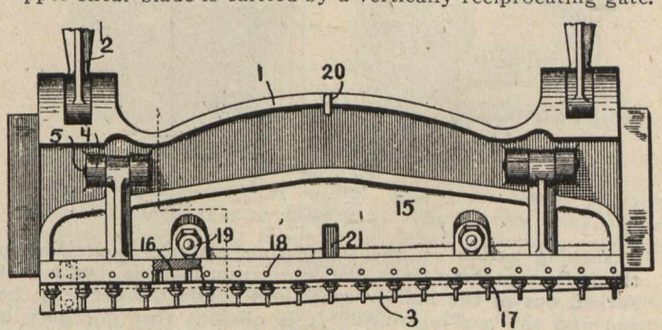
92,880.

fits down over this ferrule, both the elbow connection and the ferrule have circular recesses formed in their faces to receive a suitable gasket. A portion of the elbow overhangs the outer flange of the said ferrule, and a packing is inserted between this overhang and the outer surface of the pipe. A loose knot embraces the outer surface of the pipe and has a threaded extension to engage with the outer surface of the overhanging portion of the said elbow. Suitable lugs are provided to retain the swivel in a certain position.

UNITED STATES OF AMERICA.

Specially compiled by **Messrs. Siggers and Siggers**, Patent Attorneys, Washington, D.C.

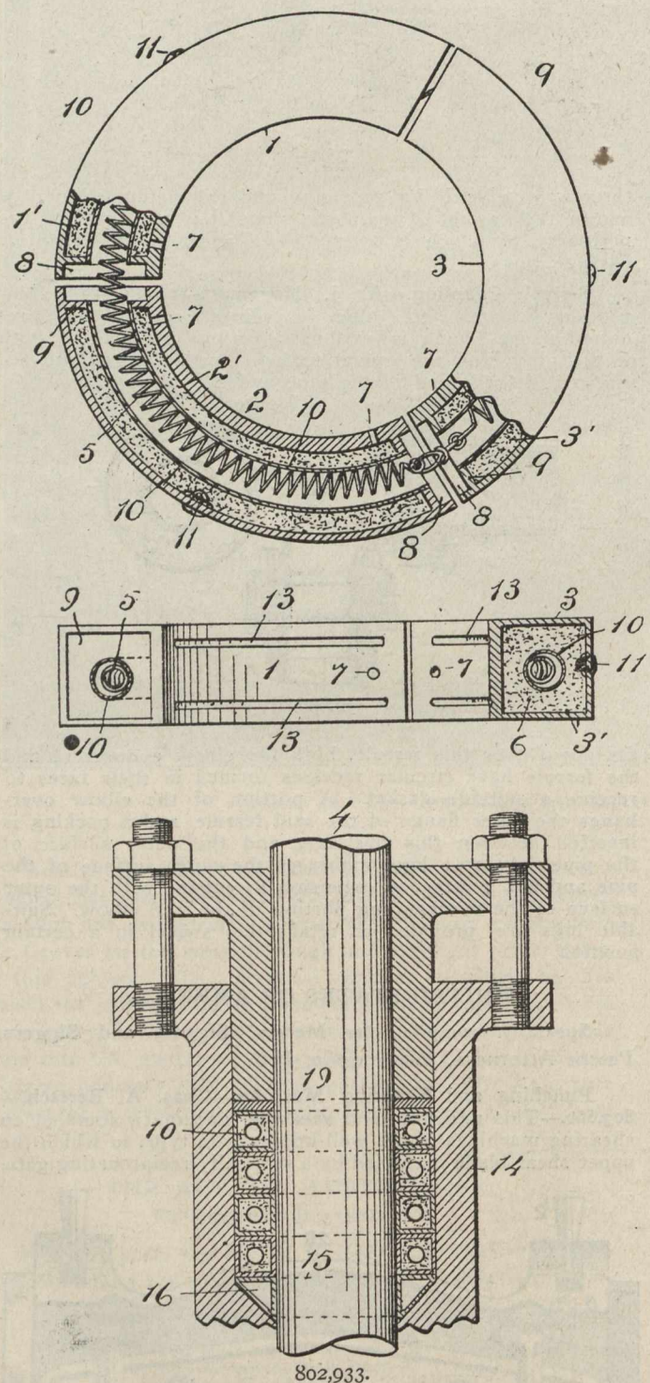
Punching and Shearing Machine.—Chas. A. Bertsch.—803,660.—This punching and shearing machine is founded on shearing machines of the well-known gate type, in which the upper shear blade is carried by a vertically reciprocating gate.



803,660.

The shear gate is provided with a punch-holder to co-operate with the dies in the table which carries the lower shear blade, so that the machine may be used for punching or shearing alternately, or for punching near the edge of a sheet, and simultaneously trimming its edge. It is practically essential that one end of the shearing blade be lower than the other, but the punches must all be in line, in order to accomplish this the portion of the gate to which the blade is bolted, is made as deep as it possibly can be without coming in contact with the sheet to be sheared, and the blade only is made lower at one end. To overcome the weakness of the blade at the wide end, a separate block is bolted on to the frame, and fixed firmly to the blade by means of a set screw. In case it is desired to use the machine without the upper shear blade, this block can be removed so that the sheets may be punched any distance from the edge.

Metallic Packing-Ring for Stuffing-Boxes.—Gustav Huhn.—802,933.—The packing-rings, consist of several parts kept together by a spiral spring, made hollow, fitted with openings in their inner surfaces, and filled with suitable lubricating material. The rod, when moving to and fro, sliding along the inner surfaces of the packing-rings, exerts



802,933.

a sucking action on the lubricating material contained in the hollow packing-rings, the lubricating material being thus sucked out of the hollow space and conducted between the rod and the packing-rings. It is obvious that not only is the tightness of the packing increased, but the wear of the material further reduced to a minimum.

Drilling Machine.— A. T. Anderson.— 801,128.— This electrically driven drilling machine, Figs. 1 and 2, is so constructed that it may be swung around to any desired point, and readily adjusted to any height, automatically. The drill is supported entirely by column 1 and base 2, the rack 5

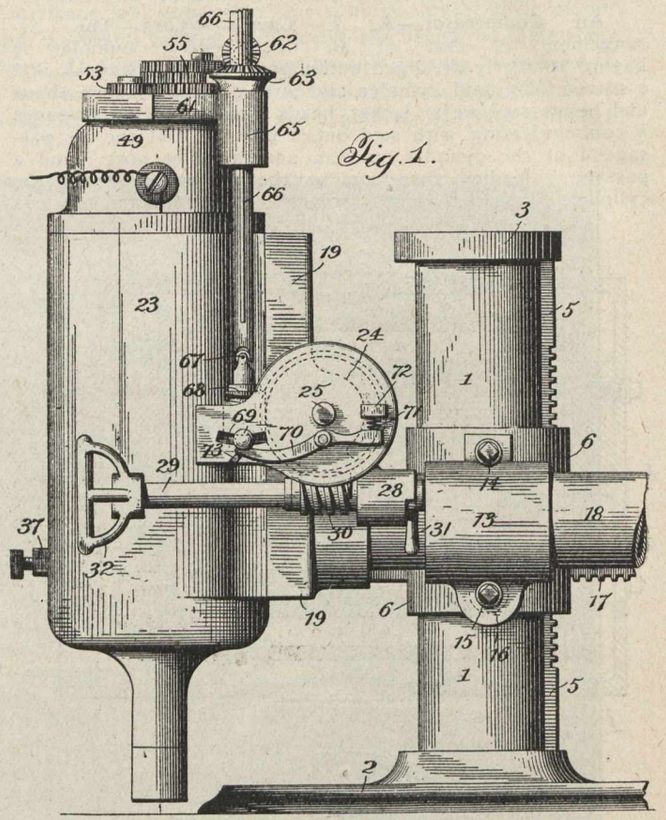


Fig. 1.

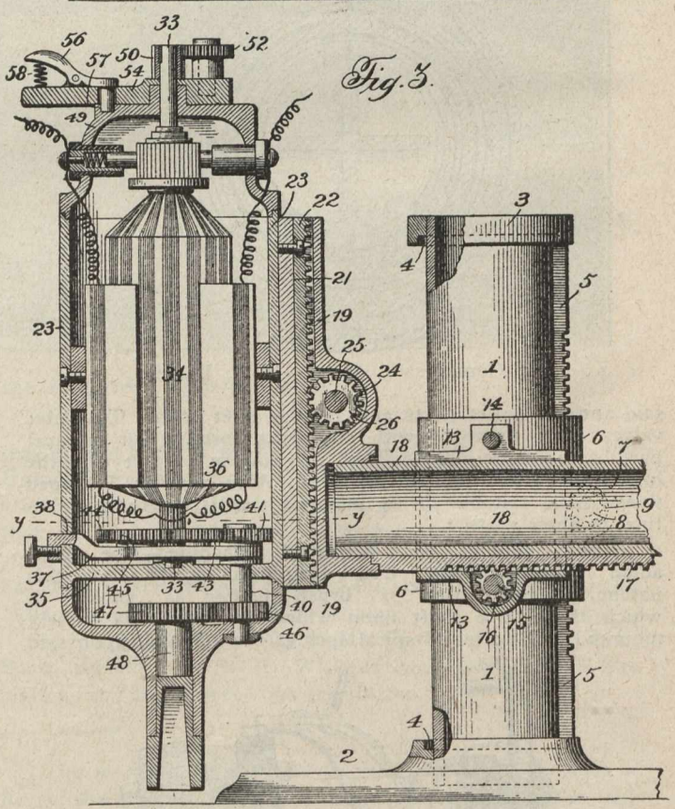


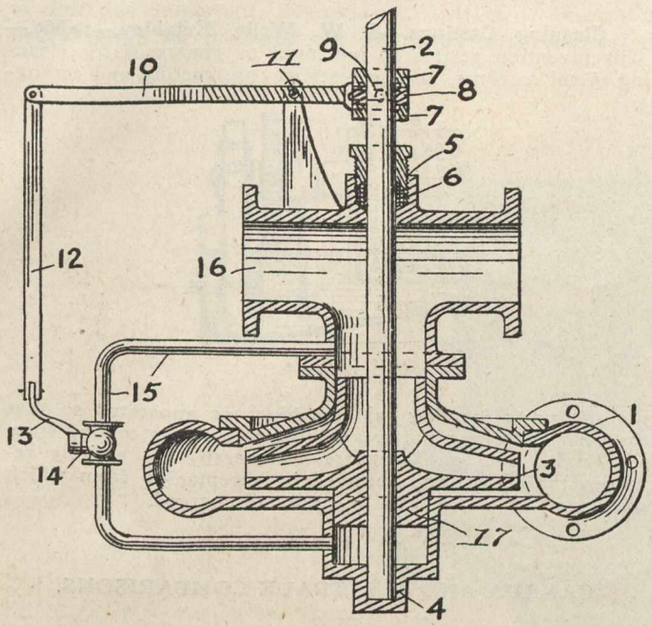
Fig. 2.

801,128.

being so arranged that it will slide around the column to any desired point. The automatic feed may be thrown out very quickly, and the machine fed by hand. The parts are compactly arranged, and very simple in construction.

Self-Governing Centrifugal Pump.—Eugene P. McMurty.—802,775.—The operation of the pump is as follows: When the pump is started, the shaft runs in the step-bearing until the pump is revolving at full speed, producing a suction or vacuum above the runner, causing the runner and shaft to rise. As the runner and shaft ascend, the end of lever 10, connected with shaft, rises with it, and opens the

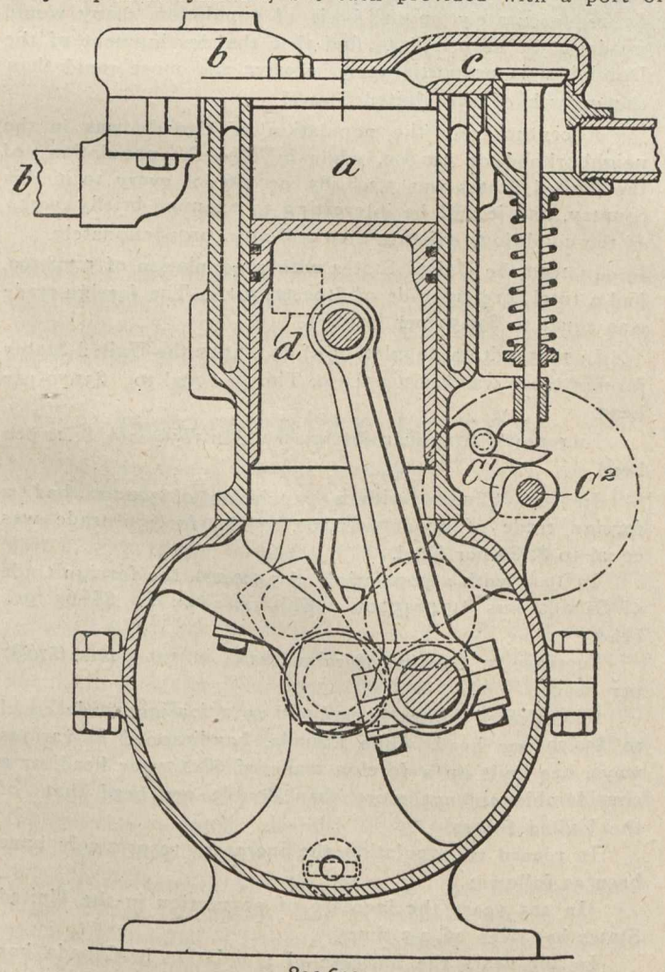
valve 14; thus opening a communication between the space above the runner and that below the runner, equalizing the pressures in said spaces. This causes the runner and shaft to descend; but as the shaft descends it reverses the operation, closing the valve 14, and shutting off vacuum from be-



802,775.

low runner; which will be replaced by pressure from water leaking in from the space above runner, again causing the runner to ascend. At some point in this operation the shaft and runner arrive at an equilibrium, and will float free in the water.

Explosion Engine.—E. T. Pollard.—803,623.—The high efficiency explosion engine shown, has three cylinders, two of which (preferably the two outside cylinders), are ordinary explosion-cylinders, but each provided with a port or

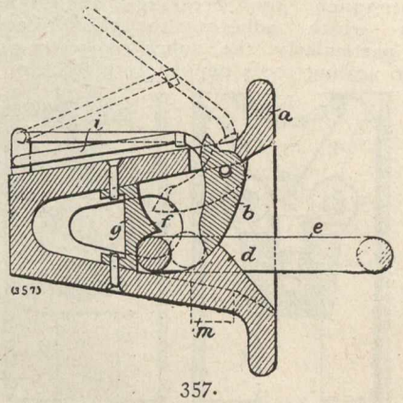


803,623.

ports so situated as to be uncovered by the piston just at the end of its out-stroke. The port communicates by a passage in which is a non-return valve with the rear of the middle cylinder. Thus the products of combustion pass from the explosion-cylinders to the middle cylinder, where they act expansively. An explosion takes place every revolution, but alternately in the two outside cylinders so that the middle piston receives an impulse every revolution. An advantage of the arrangement is that all back pressure on the pistons in the explosion-cylinders is avoided, for each explosion-cylinder has its own independent exhaust-valve, which, owing to the non-return valves in the passages, can be opened immediately the dead-centre has been passed without allowing any loss of pressure in the expansion-cylinder, and thus a very free exhaust is obtained.

GREAT BRITAIN.

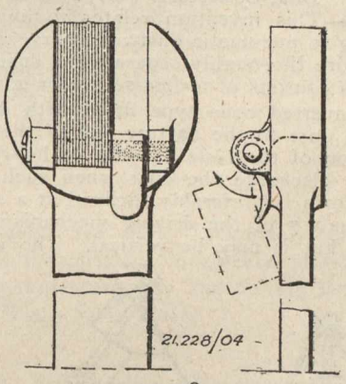
Automatic Coupling-Buffers.—Edgar Allen and Co., Limited, Sheffield.—(W. McI. Robinson and E. E. Letchford, Pretoria, Transvaal.)—357.—In the mechanical appliances at present in use the coupling-gear consists of a pin and link.



357.

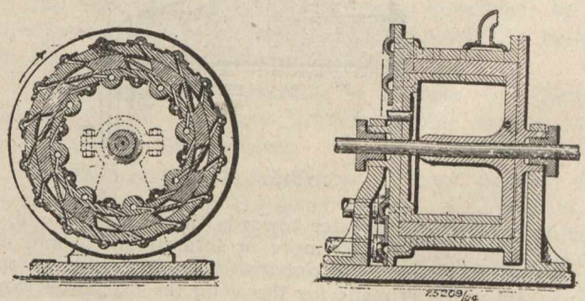
The object of this invention is to obviate the danger to which an employee is exposed in either coupling or releasing such gear, and the delay often caused by the pin becoming bent or jammed.

Wrenches, Spanners, and the like.—Raisse.—21,228.—The wrench comprises two fixed jaws and a number of movable blades, which can be inserted as desired so as to make the space correspond to the diameter of the nut, etc., to be turned.



21,228.

Elastic-Fluid Turbines.—Corthesy and Griffin.—25,269.—The turbine described has a rotor part with a number of impact vanes on its periphery, and steam impinges upon them for a number of tangential jets in the circumference

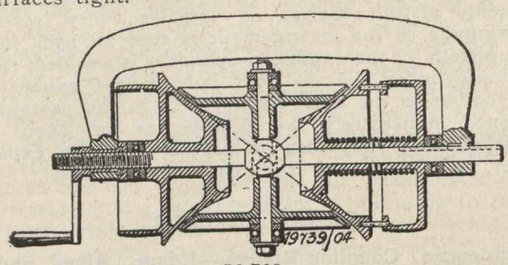


25,269.

of a stationary stator or casing. The steam supply passages alternate with exhaust passages. The turbine may be reversed by supplying steam to an inner stationary ring provided with a number of similar jets.

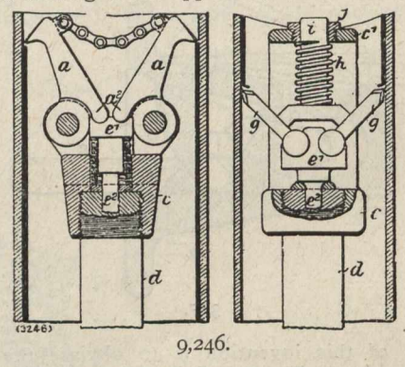
Variable-Speed Gearing.—Kenrick.—19,739.—Two cones, facing each other, are mounted on the same axis, and two beveled carried wheels are mounted on a shaft pivoted upon the axis of the cones. This shaft is caused

to move endwise by the screw and handle gear shown, and a spring is placed behind one of the cones to keep the gearing surfaces tight.



19,739.

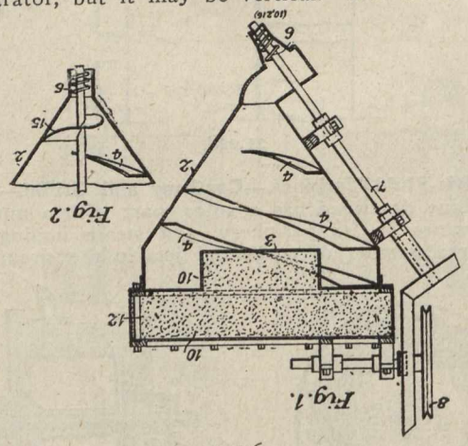
Tube Scrapers.—S. M. Cockburn, J. R. Temperley, and J. Temperley, London.—9,246.—This invention relates to a contrivance for breaking and removing the incrustation which adheres to the interior surface of tubes, particularly the tubes of water-tube boilers, *a*, *a* are two scaling tools oppositely pivoted on a socket *c*.



9,246.

which is secured to a tubular arm *d*, which contains the mechanism of a pneumatic hammer and serves as a medium for the conveyance of energy by fluid under pressure and as means for manipulating the tool and causing it to effect the desired result at every part of the internal surface of the tube.

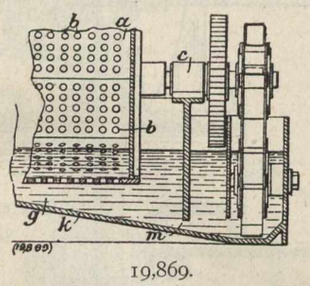
Pneumatic Dust-Collectors.—W. Tattersall, Bradford, Yorks.—10,216.—This invention relates to improvements in or appertaining to pneumatic dust-collectors, and its primary object is to more thoroughly separate the dust from the air. The apparatus consists of a dust-separator 2, which may be of the usual inverted cone type fitted with deflectors 4 to precipitate the dust to the narrow end of the cone. At or near the bottom of the cone a worm or helical conveyor 6 is provided to discharge the dust when such worm is rotated. This worm is preferably inclined at a suitable angle, so that the shaft 7 of the driving mechanism 8 is outside the separator, but it may be vertical. The worm may be



10,216.

taper or reduced in diameter towards the discharge end, so that the dust delivered is more or less solidified, and will not immediately become disintegrated under ordinary conditions. Provision is made for throwing the discharge worm in and out of action, as required. An auxiliary opening may be provided, so that the dust can be discharged independently of the worm. In connection with the air-outlet 3 a filtering medium 10 is introduced, formed of layers of fibre and cotton-wool or other suitable medium, through which the air is forced before escaping; and in order to increase the efficiency of this filter the air-outlet is enlarged in size at this point, so as to obtain a large filtering area 12 and proportionately reduced velocity of the air. For the purpose of dealing with certain kinds of dust, such as those liable to cling to the sides of the separator, a rotary scraper 15 is used, as shown in Fig. 2, which is a view of the lower portion of a dust-separator similar to Fig. 1, but with the shaft 7 of the driving mechanism vertical, to scrape the sides of the separator. This scraper may be of such a form that it also acts as a deflector.

Cleaning Castings.—S. W. Wells, Keighley.—19,869.—This invention relates to machines or apparatus for cleaning metal castings, and consists in constructing and arrang-



19,869.

ing the parts forming said machines or apparatus so that the sand and other matter adhering to castings coming from the sand mould on being treated thereby are entirely removed therefrom, and received by receptacles from which such sand or refuse can be easily discharged.

CANADA AND U. S. TRADE COMPARISONS.

In making comparisons between the trade of Canada and that of the United States, the mistake is frequently made of underestimating the Canadian rate per capita, which in reality is greater than the rate per capita in the Republic. Although the population of Canada is only about 6,000,000, whereas the people of the United States number probably 85,000,000, and the total volume of trade of the latter country is vastly larger than ours, still when the relative rate of progress made by the two countries is figured accurately on the basis of population, many would no doubt be surprised to find that the development of the Dominion is proportionately greater and more rapid than the growth of the United States.

A century ago the population of Canada was in the neighborhood of 340,000, while in 1800 the population of the United States was 5,308,483, or 166 for every 10 in this country, and it will be interesting to examine briefly some of the conditions existing then and now, proportionately.

In 1800 the United States with a population of 5,308,500, had a total foreign trade of $162,224,500. The foreign trade was equal to $30.50 per head.

In 1905, with a population of 83,145,000 the United States foreign trade was $2,636,074,350. This is equal to $31.70 per head.

Increase of American foreign trade in 105 years, $1.20 per head.

In 1800 Canada, with a population of 320,000, had a foreign trade of about $900,000. The foreign trade was equal to $2.80 per head.

In 1904, with a population of 5,500,000, the foreign trade of Canada was $454,645,700. This is equal to $82.67 per head.

Increase in Canada's foreign trade in 105 years, $79.87 per head.

The United States have built up a foreign trade equal to $31.70 per head, while Canada, handicapped in various ways, has built up a foreign trade of $82.67 per head, or a considerable amount more than double per head that of the United States.

In regard to population the increases respectively have been as follows:

In 105 years the increase of population in the United States has been 16 2-3 times.

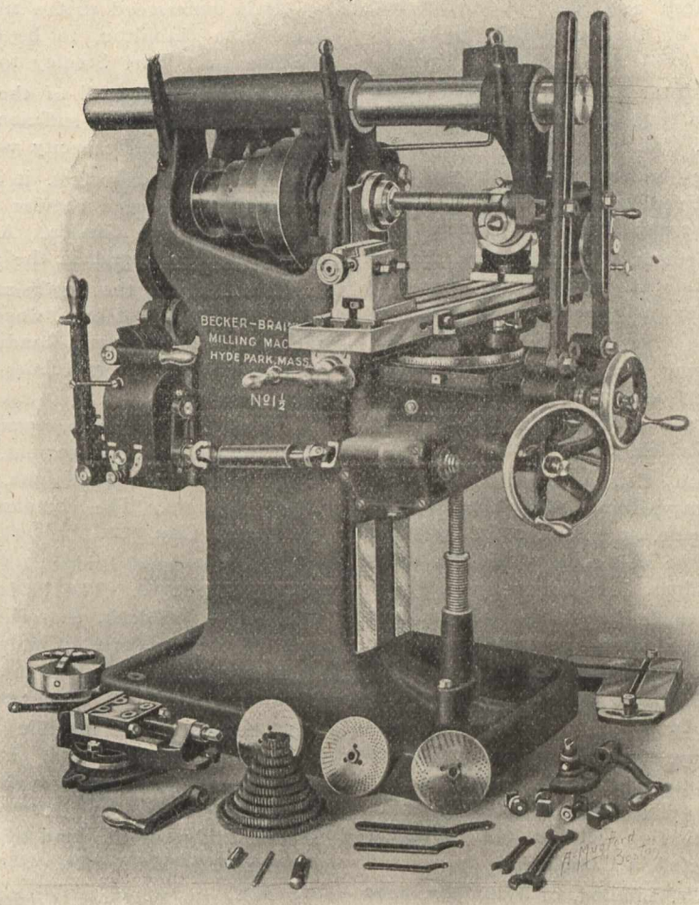
In 105 years the increase of population in Canada has been about 17 times.

Canadians have reason to feel proud of the splendid record the country has made, and the manner in which we are forging ahead to-day in the commercial world.—The Commercial, Winnipeg.

UNIVERSAL MILLING MACHINE.

Gear Feed. Range 24 x 8 x 17 ins.

The milling machine illustrated below embodies a number of new and important improvements. It is of unusually heavy design for this type and the metal is so distributed as to take care of all strains and permit of the production of high-grade work at the highest possible speed, and is amply powerful to drive high-speed cutters at the very highest limit of speed. The table feeds are positive gear-driven through spur gearing, and have a range of speeds to cover every requirement. This method of driving the table consumes the least possible amount of power, thereby permitting the spindle to drive large cutters with deep cut. The machine is also provided with a number of special features to aid the operator in quickly adjusting the work on the table, and also obtain proper speed of spindle and feed of the table for each individual operation. This machine is manufactured by the Becker-Brainard Milling Machine Co., Hyde Park, Mass.



Range 24 x 8 x 17 ins.

INDUSTRIAL NOTES.

The Canadian Fairbanks Company, Limited, has been appointed sales agent for the John Bertram & Sons Company. Messrs. John Bertram & Sons Company have long been known as the leading Canadian machine tool builders, and the product of this company is well known, not only in Canada, but all over the world, and has reached a standard which has placed it in the front rank of of machine tool builders. The Bertram Company has recently become identified with the Niles-Bement-Pond Company, and with the facilities offered by this company the Fairbanks Company will be able to offer the Canadian public the very latest and best machine tool construction.

The Canadian General Electric Co., Toronto, received the contract to supply the city of Winnipeg with an electrical generator to cost $27,500.

A new industry for Hamilton is the Banwell-Hoxie Wire Fence Company, the Canadian branch of the McGregor-Banwell Company, of Adrian, Mich. It will locate on Princess Street. It has a capital of $100,000.

Holt, Renfrew & Co., the celebrated fur concern of Quebec, will light the village of Indian Lorette. A Crocker turbine, developing 300 h.p., built by the Jenckes Machine Co., Limited, of Sherbrooke, Que., will be the prime mover.

The Robb Engineering Company are building two 25-h.p. boilers for McGill University, Montreal.

Rapid progress is being made with the new Bertram shops. The place is visited by many interested ones each day.

The Vancouver nail factory was destroyed by fire Tuesday. The loss is estimated at $50,000. The building and plant was partly insured.

Owing to the large increase in business the Canadian General Electric Co. have undertaken the erection of a large warehouse in Montreal.

The William Richards Company have ordered from the Robb Engineering Company two 150 h.p. engines and four 75 h.p. boilers for their mill at Campbellton, N.B.

The Newville Lumber Co. are rebuilding their mill near Parrsboro', N.S., which was destroyed by fire a short time ago. A large engine and two boilers, manufactured by the Robb Engineering Co., will be installed.

The work of excavating for the new foundry to be erected at Glace Bay for the Dominion Coal Co. has been commenced. The building will be ninety by one hundred feet, about twice the size of the present foundry. The building will be of brick and steel, and will cost over $25,000. It is expected that it will be completed inside of three months. The capacity will be ten tons per day.

A steel mill is to be established at Fort William which will give employment to 200 men.

The London Waterworks Commissioners have asked for $250,000 for improvements to the system.

The Dominion Coal Company has decided to ask for protection against the importation of British and United States anthracite coal.

The North-West Machinery and Iron Co., Limited, have assigned for the benefit of their creditors. John W. Lord is the assignee.

The Canada Cycle and Motor Co. have started work on the erection of a brick building for manufacturing automobiles at Toronto Junction, Ont.

Fire that started in the boiler-room destroyed the shingle mill of the Fraser River Lumber Company, New Westminster, B.C. Loss, $12,500; insurance, $7,000.

The Lehigh Portland Cement Co., Allentown, Pa., is receiving bids on various kinds of machinery to be used in a cement plant which they will be erecting early in spring near Belleville, Ont.

Two new turbines are being placed in the wheel-pit of the Canadian Niagara Power Company by I. P. Morris & Co., of Philadelphia. They are similar to those installed by Esser, Weiss & Co., of Zurich, Switzerland.

The Goldie & McCulloch Co., of Galt, Ont., are building for the Alex. Brown Milling Co., Toronto, one tandem compound Corliss engine, 15 in. and 28 in. by 36 in. This engine will be used in the new mill, which the above mentioned company are building.

Preparations are being made by British Columbians interested in the coal mining industry to make an active campaign at the next session of the Federal Parliament of Canada for the establishment of free trade in coal between the United States and Canada.

The Canada Car Company, the big company formed by Toronto and Montreal interests as the result of the Grand Trunk Pacific project going through, set their entire plant near Montre in operation on October 30th. The car shops are the largest yet erected in Canada.

The Manitoba Iron Works, Limited, of Winnipeg, have completed the water tower contracted for with the town of Portage la Prairie, and Engineer Chipman has passed same as entirely satisfactory. This is the largest contract of the kind yet undertaken in Western Canada.

A London engineer of high standing in his profession, who has just returned from Canada, speaks highly of the efficiency of the iron works and mills at Sydney and Sault Ste. Marie. They are equal, he says, to anything of the same class in this country or the United States.

The Dominion Coal Co., Glace Bay, N.S., has placed an order with the Goldie & McCulloch Co. for three cross compound, non-condensing engines, 19 in. and 30 in. by 30 in. These engines are to be direct connected to sixty cycle generators, and will run at 120 revolutions per minute.

The Jenckes Machine Co., Limited, Sherbrooke., Que., is furnishing the Standard Chemical Co., Limited, of Toronto, two 100 h.p. 66-inch diameter by 16 feet long horizontal tubular boilers and five wood alcohol storage tanks, 17 feet in diameter by 16 feet high. Boilers and tanks will be shipped to Montreal.

M. J. O'Brien & Co., whose mine is on the edge of Cobalt lake, recently bought from Allis-Chalmers-Bullock, Limited, a complete power house equipment, including boilers, hoisting engines, 7-drill compressor plant, boiler feed-pump, large general supply pump, high-speed engine and generator for electric lighting.

A large addition is being made to the coal-washing equipment of the Dominion Iron and Steel Company in the form of a trestle, pockets and conveyors for taking care of the storage of fifteen thousand tons of coal. The work is being done by a Pittsburgh firm. The rest of the washing plant has been definitely taken over by the steel company, and it is expected that the first section of the new work will be finished by Christmas.

Fire recently destroyed the Canada Brass Company's Supply Works at London, Ont.

The Canadian General Electric Company at Peterboro' will extend the works in the spring.

The Keewatin sawmill and contents, valued at $60,000, was totally destroyed by fire Monday night at Keewatin. Fully covered by insurance.

It is understood that a trolley line is to be built from London to Hamilton, to be operated in connection with the line from Port Stanley to London.

The steel rail mill of the Lake Superior Corporation at the Soo now has sufficient orders booked to keep it running to its full capacity well into 1906.

Welsh coal exporters, it is understood, are discussing the establishing of a regular trade in anthracite coal between Wales and Canada. A number of firms are taking a very active interest in the matter.

Dr. Heroult, the eminent French authority on the electric smelting of ores, was in Ottawa lately en route to the Soo, where he will conduct a number of experiments in that line at the industries there at the instance of the Government.

A million dollar company has been incorporated to manufacture Portland cement, consisting of E. T. Malone, J. W. Mitchell, A. L. Malone, A. Mearns, and J. A. Fraser, all of Toronto. The company will have headquarters in the Queen City.

The new steel bridge at French Fort Cove was opened on October 23rd. The bridge was built and erected by Charles D. Ruddock, proprietor of the Miramichi Foundry and Machine Works, Chatham, N.B. All the materials used except the steel were found on the Miramichi, and only Miramichi workmen were employed.

The work of installing the new steel bridge at Mooney's Mills, Morell, has been completed by Mr. McNeill, of New Glasgow, N.S. The bridge is forty feet long, and is built on abutments of hard pine. This is the second bridge of the kind to be installed by the Provincial Government this season.

Canadian Bearings, Limited, Hamilton, Ont., announce that they hope to commence shipments early in February. In the meantime they will send an illustrated booklet to all who are interested in roller bearings for any purpose, and want to get a fully tested and guaranteed article at half the price of any other bearing now on the market.

The Cartierville Electric Light and Power Company have secured a twenty-five year franchise for the lighting of the town of Bordeaux. The same company has also the contract for furnishing light and power to the town of St. Laurent, Que. Charles Brandeis, C.E., of Montreal, is the consulting engineer.

Dodge Manufacturing Company, of Toronto, have just shipped the last car load of machinery on their contract with Grand Trunk Railway system for equipment for Windmill Point elevator, Montreal. This shipment consisted of six reversible trippers of special design, and which are highly spoken of by the architect.

Announcement is made that with the November issue "The Southern Engineer" changes ownership. The Southern Engineer Publishing Company, Atlanta, Ga., having disposed of the property to the W. R. C. Smith Publishing Company. Under the new ownership the journal will be improved and enlarged, and with this end in view the best editorial talent available has been engaged. We wish the W. R. C. Smith Company every success.

Percy Pitman, Bosbury, Ledbury, has booked orders for the following Pelton water wheels: 150 b.h.p. for Messrs. the British Mining and Metal Co., Limited, London, for their Devonshire mines; large Pelton wheel for Messrs. the Glyn Slate Co., Limited, for North Wales; high-pressure wheel for Messrs. the Cyanide Plant Supply Co., London, for South Africa; multiple nozzle wheel for Messrs. A. & Z. Daw, London, for Rio, Mexico, and Mr. N. Wanganui, New Zealand.

The Petrolia Packing Company's plant was destroyed by fire on November 1st.

The Jenckes Machine Co., Limited, of Sherbrooke, Que., has recently shipped a 14 in. x 20 in. double drum Lane friction winding engine, drums 72 in. diameter by 36 in. face, to the Dominion Coal Co., Limited, Glace Bay, C.B., and is at work on a single drum hoist of the same size for the same company.

The H. K. Wampole & Co. have changed their order previously given for the engine for the new factory in Perth for one with a third larger capacity. The company will generate their own electricity, installing a plant of their own. Parts of their machinery is ready for shipment, and is equipped with the Chapman roller ball bearings.

An alliance of great benefit to the "Soo" industries has been formed between the Lake Superior Corporation and the Canadian Pacific Railway. The big railway is now getting over $100,000 a month for hauling the business of the different subsidiary companies of the Lake Superior Corporation. In return, the Canadian Pacific has become the largest and one of the most profitable customers of the steel rail mill of the Algoma Steel Company.

The Westinghouse Machine Co., of East Pittsburgh, Pa., has within the last few weeks booked orders for more than seventy-five steam engines, aggregating 10,764 h.p. Of the different types of steam engines manufactured by this company, 5,040 h.p. of marine type were sold, 2,740 h.p. of compound steam engines, 1,823 of standard, 801 of junior, and the remainder of Corliss. The largest single order during this time was received from the Tahuantopec Railway, of Mexico, for four 16 in. and 34 in. by 16 in. marine type engines and two 8½ in. by 8 in. standard engines for equipping their Salina Cruz and Coatzacoalcos power houses.

The Jenckes Machine Co., Limited, Sherbrooke, Que., has received an order from the Granby Consolidated Mining, Smelting and Power Co., Phœnix, B.C., for a 150 h.p. double drum electric hoist. The dimensions of the drums, which will be conical in shape, are 7 feet diameter at the larger end, 5 feet diameter at the smaller end, and 5 feet long. By means of friction clutches each drum can be operated independently of the other, and both drums are also controlled by powerful brakes. The capacity of this hoist is a load of 10,000 lbs., raised at a rate of 700 feet a minute, and the shipping weight is in excess of 50,000 lbs.

It is announced that the Pratt & Whitney Company has purchased a plant in Dundas, Ont., for the manufacture of its full line of small tools—taps, reamers, milling cutters, punches, dies, etc. This building is a modern structure, and the power plant is already in place. The machinery equipment is being got ready at Hartford, and will be sent on and operations begun immediately. The plant, we are informed, will also include a department for manufacturing a full line of twist drills, an elaborate equipment of special machinery having been gotten ready for the purpose. The location of the factory is near that of the John Bertram & Sons Company, which, as has been announced, was recently purchased by the Niles-Bement-Pond Company.

MARINE NEWS.

The Dominion Government is being urged to construct a new dry dock alongside the present one at Levis, Que., 1,000 feet long, and considerably wider than the present one.

There is every indication that Fort William harbor will be open this year until December 15, or ten days later than usual. For the first time in the history of the port an ice-breaker will be stationed there.

The Richelieu and Ontario Navigation Company is opening up a new line route from Quebec to Tadousac via the North Shore, calling at the usual North Shore points with the addition of Isle au Coudres, St. Simeon (St. Catharines Bay.)

The Georgian Bay canal surveying party which has been stationed on the Manitou Islands, has moved its quarters down to French river.

The steamer "Philip Minch" has been chartered at Fort William by merchants of Winnipeg to load three hundred and forty thousand bushels of wheat. This will exceed the largest cargo that has hitherto been carried out of Fort William by over 50,000 bushels.

It is rumored that the C.P.R. have purchased the steamers "Huronic," "Monarch" and "Saronic" from the Northern Navigation Co., and that these steamers will be operated in connection with the company's present line, giving an almost daily service to the head of the lakes.

It is understood that the Minister of Public Works is likely to accede to the wish of the different power owners and favorably consider the proposal made for the construction of a series of dams to regulate the water-flow of the Upper Ottawa.

Engineers for the waterways commission say that the use of 4,000 cubic feet of water at the Soo per second, would lower the level of Lake Superior about one-fifth of a foot and that the use of 6,000 cubic feet would lower it one third of a foot.

The 24-inch hydraulic suction dredge "Northumberland," was launched from the yards of the Polson Iron Works, Limited, Toronto, on October 30. The "Northumberland" represents the most modern practice in hydraulic dredges, and is capable of dredging in 40 feet of water.

Work is progressing rapidly on what is known as Lock No. 1 on the Lachine Canal. The work of constructing this lock and also Lock No. 2 has been going on for the past three years, and is now about completed. The locks will be open to navigation on the first of May next.

Dr. W. F. King, Chief Astronomer of Canada, and Mgr. Laflamme, C.M.G., of Laval University, are making an investigation into the geological conditions of the bed of the famous cataract at Niagara Falls with a view to recommending a plan for the best means of preserving the formation.

A new steamer is to be built by the Pacific Coast Steamship Company for freight purposes entirely. It was announced Saturday that bids would be received for a wooden vessel capable of carrying about 1,500 tons of freight. She will have no regular run, but will be used where there is the greatest demand for tonnage.

Two engineers have been sent to Winnipeg river to work on the Great Falls power project. They represent the Chicago capitalists who have purchased $6,000,000 of the bonds of the company. Preliminary work was begun at the site of the proposed power dam some time ago, and it is the intention of the company to increase the force of men and prosecute the construction of the works as rapidly as possible.

It is learned that the Algoma Consolidated Companies are negotiating with the Collingwood Shipbuilding Company for the construction of a new steel steamer. The proposition is to build a steamer 550 feet in length, with 56 feet beam and 28 feet in depth, of ten thousand tons burthen. The engines and boilers are to be modern in every particular, while the boat would be equipped from end to end with every convenience for quick dispatch.

J F. Fraser, Commissioner of Lights of the Marine Department, left Ottawa on October 23rd for the Pacific coast, and will be absent about six weeks, and will inspect all the aids to navigation. On his return a complete scheme of the improvements required in the lighting of the coast will be submitted to the light-house board. Mr. Fraser has charge of the re-lighting of the St. Lawrence route. A second order quick-flashing light, the first of the series of new coast lights to be provided, was put into operation on October 20 at Gannet Rock, Bay of Fundy.

Twenty-thousand dollars is the amount estimated as the cost of repairing the Peterboro' hydraulic lift lock, by reason of a leak which has developed in the embankment of the upper reach. Water has been percolating through the embankment, which has been built up, and the condition

of the lock is causing the officials no little concern. Last year, the first season that the lock was in operation, between $5,000 and $6,000 was spent in repairs. The matter is being reported to the Department of Railways and Canals and an investigation is being asked for to determine upon whom the responsibility for the condition of the embankment should rest.

RAILWAY NOTES.

There is a movement on foot for a new G.T.R. depot at Windsor.

The C.P.R. will haul almost twenty million bushels of wheat to Fort William this season.

The G.T.P. is seeking to change its agreement with Fort William in order that it may parallel the C.N.R.

The Minister of Railways states that the Intercolonial Railway will be put on a paying basis at the next session.

The C.N.R. line is now within ten miles of Edmonton, and track laying is going on at the rate of two miles a day.

It is reported at Winnipeg that J. J. Hill will do a lot of railway building in the West, including a line to Hudson's Bay.

City Engineer Rust estimates that the cost of depressing the railway tracks through South Parkdale, Toronto, would be from $500,000 to $750,000.

James J. Hill will add the Canadian Pacific and the Missouri, Kansas and Texas railroads to his list of properties.

It is reported that the Grand Trunk Pacific intends to go ahead speedily with the construction of branch lines in the West, which will act as feeders to the main line.

The temporary bridge across the Saskatchewan is about a trolley line from Hamilton on London, to be operated in connection with the line from London to Port Stanley.

The location survey work on the New Brunswick section of the National Transcontinental Railway is expected to keep the surveyors at work throughout the winter.

The Grand Trunk Pacific and Canadian Northern have reached an agreement which will result in Winnipeg having a fine new union depot, to cost $3,000,000 to $4,000,000.

The Canadian Pacific, according to newspaper reports, will put up additions to its Angus shops at a cost of $52,350; also a building for its employees, 116 x 70 feet, to cost $32,000.

Railway trackmen say that the roadbed of the C.P.R. at the present time is in excellent condition, and that the track work along the line is well advanced for this time of the year.

Messrs. Ross & McRae, the well-known railroad contractors, have been awarded the contract for the construction of the St. Maurice Valley Railway, running from Three Rivers to Shawinigan Falls, Quebec.

Railway men are of the opinion that the G.T.R. should raise the tracks through the city of London from just west of the Cove Bridge to beyond the east limits of the city. This work would involve the expenditure of a million dollars.

The town council of Portage la Prairie has decided to work in conjunction with the Grand Trunk Pacific Co. in constructing a passenger and traffic bridge over the Assiniboine river, provided it is located in the vicinity of High Bluff ferry.

The C. P. R. announces that the company will take over the Tilsonburg, Lake Erie and Pacific Railway, which it has leased, and operate it as district No. 2 of the Ontario division. The road is 35 miles long, running from Port Burwell to Tilsonburg.

The Ottawa city council has received a letter from Mr. C. M. Hays, of the Grand Trunk system, in which he says that he expects to be in a position shortly to make a definite statement in reference to the construction of a central depot in Ottawa.

According to plans filed at Ottawa by the Grand Trunk Pacific, and now in possession of Mr. Collingwood Schreiber, of the Department of Railways, who is at Saskatoon, the main line of the Grand Trunk Pacific will cross Saskatchewan two and three quarter miles southwest of Saskatoon.

The T. H. & B. has installed an electric inter-locking plant at Garth St., Hamilton. It is the only one of its kind in Canada. It has eighty-four levers, and will save the company the expense of maintaining a corp of switchmen. It works very rapidly and prevents all chances of collision in that section.

A letter from Mr. Atwater, assistant west of the Detroit and St. Clair rivers, to General Manager Hays, of the Grand Trunk, to the Detroit city council, relative to the grade separation, indicates quite clearly that the Grand Trunk intends to use the new Michigan Central tunnel between Detroit and Windsor, in addition to the other railroads.

Talk of an electric railway line from Sarnia to London has been renewed. Capitalists at Chatham, Windsor, London and Sarnia have been approached, and the merits of the proposed road are being carefully considered. It is probable that a company will be soon organized and a charter applied for at the next session of the Ontario Legislature. The route has not been definitely decided upon, but will possibly parallel the northern line of the Grand Trunk, going to London by way of Forest and Parkhill.

MINING MATTERS.

The American Mining Congress was held at El Pasco, Texas, November 14-18.

It is understood that Mackenzie & Mann intend to go extensively in for the mining of iron on the north shore of Georgian Bay.

The Nova Scotia Steel & Coal Company contemplates developing its areas at Little Bras d'Or on an extensive scale.

The new zinc smelter at Frank, Alta., which is now nearing completion, will be the most modern on the continent.

The Mines branch of the Department of Trade and Commerce, has issued a report on the subject of asbestos. It says Canada now controls the output of the world.

After studying mining methods in Britain and the Continent for two months, Mr. James Ross, President of the Dominion Coal Company, has returned home.

It is reported that Mr. Moxham, who was manager of the steel works at Sydney, is to take over control of the Colonial Copper Company's work and mines at Cape d'Or.

The Consolidated Cariboo Hydraulic Company of British Columbia, has sold out to the Guggenheim, John Hays Hammond and Myers interests, of New York, for $1,000,000.

A seam of coal forty-seven feet thick, has been penetrated by the new Allan shaft of the Acadia Coal Company at Stellarton. Such a deposit is said to be unprecedented in the records of mining.

The price of shares in the Hill Mining & Smelting Company has made a notable and rapid advance on the London market. Within the space of a fortnight they have risen from 1s. 6d. to 3s. 6d. per share.

Chief Engineer Sylvester, with a party of men, has been surveying the right-of-way for an electrical transmission line from Copper Cliff to the Creighton mine. The Company proposes next spring to carry to the Creighton electrical power for the operation of the mines. A new shaft has been started at the Creighton and timber is being secured for a new rock house which will have a larger capacity than the present one. A new power house will also be built for the electric motors and the work in both rock houses will be operated from this station.

The Great Northern Oil & Gas Company has struck what is regarded as being the best well yet drilled at Manitowaning. When the drill had reached a depth of 450 feet the oil filled the hole and gushed fully fifteen feet in the air. It was entirely free from water. When the pump was placed and started it pumped fourteen barrels of pure oil in twenty minutes. The well has not yet been shot. This will remove every vestige of doubt that Manitoulin Island is destined to be in the near future a great oil-producing field. The oil is found in the Trenton limestone, and is of very superior quality, being equal to the best grade of Ohio oil.

LIGHT, HEAT, POWER, ETC.

Fenelon Falls is to have a new arc lighting system.

The capacity of the Minnesota Electric Light plant has been doubled.

A public steam heating plant is being installed at Chatham, Ont.

A company has been formed at London, Ont., to develop electric power from the Thames.

W. M. Doull and Elwood Hosmer were recently at Rossland, B.C., attending the annual meeting of the West Kootenay Light & Power Company.

A plan is on foot, it is said, to generate power for London by harnessing the Thames between Springbank and Kilworth, and the erection of a large power house. A company is now said to be in the course of organization.

The new electric power house at Indian Head, Sask., is being rushed up and workmen are engaged in putting up the poles. It is expected that the town will be equipped with a complete electric light system by Christmas.

The city council of Montreal have decided to engage Professor Edward W. Bemis, of Vanderbilt University, Cleveland, Ohio, to report to it on the cost of providing a municipal gas plant for the city, and also on the price at which such a plant would be able to supply gas to the citizens.

Rumor is current in London, Ont., that the London Street Railway will pass into the hands of local men. Vice-President Smallman of the city, and several other Londoners are said to have an option on the line. H. A. Everett, of Cleveland, is the chief owner.

The Calgary lighting plant, erected at a cost of $60,000, after an exciting election where only thirty votes out of six hundred were cast against it as a protest against a private corporation which had enjoyed a monopoly for many years, is now ready for operation. The plant can supply, in addition to the street arc lights, six thousand domestic lamps.

Mr. Holt, President of the Light, Heat & Power Company, Montreal, states that if the by-law providing for the placing of electric wires underground is enforced it will cost the city over a million dollars to instal a conduit system for the fire alarm department wires, and will result in an increase of over 100 per cent. in the price of light, heat and power.

W. M. Douall, President of the West Kootenay Power & Light Co., Limited, stated that the cost of the installation of the new machinery at Bonnington, on Kootenay River, together with the poles, will be about $1,000,000. The company will have 28,000 horse power for industrial purposes and expects the lines into the boundary will be ready for transmission purposes in March or April.

PERSONAL.

A. C. Dennis has been appointed Division Engineer, Prairie East Division, with headquarters at Winnipeg.

A. W. McKinley has been appointed manager of the Electrical Construction Co., at Brantford, Ont. He commenced his duties October 28th.

Willis Chipman, Civil Engineer, Toronto, recently made a visit to the Western Provinces.

J. S. Covert, civil engineer of the I.C.R. engineering department at Moncton, is critically ill at Campbellton, and all hopes for his recovery have been given up.

Angus A. Ferguson, for the past nine months underground manager of Phalen seam, Dominion No. 2, has entered upon his duties as manager of the C. B. Coal, Iron and Railway Co.'s mine at Broughton.

Beauchamp H. Smith, second vice-president of the S. Morgan Smith Co., of York, Penn., died at his home in Los Angeles on November 1st at the age of thirty-six years. Mr. Smith went to Los Angeles about five years ago for the benefit of his health, since which time he has resided there, and hopes of a complete recovery were entertained.

Dr. J. B. Porter, Professor of Mining Engineering at McGill University, has returned to the city after an absence of more than four months. Leaving Canada early in June, Professor and Mrs. Porter spent about six weeks in England, and then went on to South Africa, where the professor was one of the guests of the British Association for the Advancement of Science, which met for the first time in that quarter of the world. There were about three hundred persons in the party, including about twenty who were invited from other than British countries. Two other Canadians, Prof. Coleman and Dr. McCallum, both of Toronto, were of the party.

The tenth commemoration of Founder's Day of the Thomas S. Clarkson Memorial School of Technology will be observed with appropriate exercises in the assembly hall of the school, November 30, 1905. The address will be delivered by John Cassan Wait, Member American Society of Civil Engineers, an attorney and counsellor at law of the city of New York. Mr. Wait is the pioneer in a specialty in the practice of law, that of Engineering and Architectural Jurisprudence. In this branch he has now established a successful practice, and is an acknowledged authority. He is the author of several books on the subject, such as "Law of Operations Preliminary to Construction in Engineering and Architecture," "Engineering and Architectural Jurisprudence," "Laws of Contracts.'

MUNICIPAL WORKS, ETC.

It has been decided to install a steam plant for the waterworks at Levis, Que.

A system of sewerage will be installed at Fort Frances, Ont., as early as possible, under the direction of Mr.. John Galt, C.E., Toronto.

The Winnipeg City Solicitor has been instructed to prepare a by-law authorizing an expenditure of $600,000 for a municipal gas plant.

The new 5,000,000 gallon pump for the St. Thomas waterworks has arrived and will be put in position at once. The three new filters are now at the works and are being installed.

It is learned that to give Brantford the needed surface drainage system will require an expenditure of $200,000. Of this $91,000 will be needed in the central portion of the city. Experts claim that surface drainage must be secured before pavements can be put down.

The waterworks at Hantsport are about completed, and have been handed over to the town by Contractor W. J. Mulhall. The system cost $40,000. The water, which was brought from a lake on the North Mountain, is excellent and the town will be greatly benefited.

The plans for the new building to accommodate the new 12,000,000 gallon Worthington pump to be installed at the Montreal low level pumping station are now ready, and available for inspection. The tenders for the erection of the building will be opened and considered at the next meeting of the Water Committee.

TELEGRAPH AND TELEPHONE

The long distance telephone line of the Bell Telephone Company running from Cardinal to Shanley has lately been extended to Spencerville. Over this line, which starts at Cardinal, it is possible to get connection with the villages of Pittston, Brouseville, Shanley, Ventnor and Spencerville.

A number of enterprising citizens have organized an independent telephone company for operation in Tilbury North, when connection will be made with Tilbury-on-the-Lake, Stoney Point, Comber and with farmers along the line.

St. Joseph's professor of telegraphy, Thomas Myler, has just produced a telegraphic instrument that may yet rival "Marconi." Mr. Myler has given considerable time to "experimental telegraphy," and this is the result of his efforts.

NEW INCORPORATIONS.

Ontario.—The Cobalt-Canadian Mining and Milling Co., Kingsville, $500,000; S. L. McKay, B. Jasperson, G. Jasperson, D. Wigle, W. A. Smith, H. J. Cooper, Kingsville, Ont.

The St. Catharines Building and Paving Co., St. Catharines, $50,000; J. T. Petrie, J. Johnson, F. A Henry, A. W. Marquis, J. A. Keyes, W. B. Burgoyne, St. Catharines.

The Ontario Minnesota Mining Co., Port Arthur, $60,000; J. D. Ensign, G. A. Elder, V. Stearns, Duluth, Minn.; W. W. Blackshaw, West Superior, Wis.; G. F. Piper, Minneapolis, Minn.

The Toronto Motor Boat Co., Toronto, $40,000; J. C. McLachlan, J. G .Robinson, W. H. Cox, G. McLachlan, W. J. Elliott, Toronto.

The Gordon Cobalt Silver Mining Co., Toronto, $200,000; J. F. Lennox, J. D. Lamont, W. N. Irwin, S. B. Woods, Toronto; T. H. Lennox, Aurora.

Canadian District Heating Co., Hamilton, $250,000; W. W. Stewart, W. P. Witton, W. J. Clark, R. B. Griffith, Hamilton; J. H. Williamson, Toronto.

The Adjustable Axle Nut Co., London, $31,000; R. C. Williams, A. R. Simpson, J. Sussex, W. E. Davis, London; W. T. Pridham, Toronto.

Cobalt Development Co., Toronto, $1,000,000; T. H. Hamilton, E. MacKenzie, G. Stevenson, Toronto; P. L. Hobbs, Cleveland, Ohio; C. Magee, Ottawa.

The Standard Ideal Company, Limited, Port Hope, Ont., $500,000; H. T. Bush, A. E. Pipher L. Bush, A. M. Pipher, Port Hope; R. C. Donald, Toronto.

The Imperial Silver Mining Co., of New Liskeard, New Liskeard, Ont., $250,000; M. McLeod, J. M. Young, W. E. Kerr, W. J. Middleton, H. Bennett, R. G. Zahalan, A. N. Morgan, New Liskeard, Ont.

The Electric Meter & Stamping Co., Toronto, $200,000; A Krane, W. Bullock, J. Creighton, F. Sinclair, G. Kerwin, Toronto.

The Haldman Natural Gas Co., Dunnville, Ont., $40,000; R. A. Harrison, F. J. Ramsey, F. R. Lalor, H. Harrison, M. M. Ramsey, L. A. Lalor, Dunnville, Ont.

The Triple Link Mining and Developing Co., New Liskeard, Ont., $40,000; E. Brown, E. C. Symon, W. V. Cragg, A. Wismer, F. E. Liddle, J. A. Badger, G. Hansman, J. I. Dixon, F. W. Ferguson, New Liskeard, Ont.

The Alexander Oil and Development Co., Toronto, $100,000; A. R. Boswell, J. Montgomery, J. G. Shaw, H. W. Edgar, A. M. McGlashan, Toronto.

The Economy Powder Co., Ottawa, $10,000; F. J. Boyer, J. T. Embree, A. W. Heim, Reading, Pa.; J. R. Wyld, P. L. Neame, Ottawa.

Ruethel Mining Co., Windsor, $250,000; W. A. Thorpe, H. C. Rees, W. W. Newcomb, C. M. Hovey, A. McPhail, J. W. Wolst, G. J. Munsell, F. Zabriskie, A. K. Sweet, Detroit, Mich.

The Niagara Engine Works, Niagara Falls, Ont., $50,000; E. R. Lundy, H. G. A. Cook, F. G. Kick, H. M. Robinson, Niagara Falls, Ont.; J. A. Keyes, St. Catharines, Ont.

The Big Dipper Mining and Milling Co., Peterboro', $2,500,000; S. Sager, J. S. Waldron, Peterboro'; J. M. Fletcher, J. J. Tisdale, Buffalo, N.Y.; J. Jamieson, Barrie; A J. Reed, E. J. Wilson, B. F. Hayward, G. H. Bradley, Bolivar, N.Y.

The Silver Gulch Mining and Prospecting Co., Cobalt, $75,000; L. H. Timmins, T. J. Harwood, Mattawa; R. A. Cartwright, Belleville; W. J. LeHeup, Cobalt; D. A. Dunlap, Haileybury.

Cobalt Merchants Mining Co., Toronto, $200,000; H. B. Wills, R. Falconer, W. Vandusen, W. D. Scott, Toronto; J. S. Humberstone, York.

The Margaret Mining Co., Toronto, $40,000; D. D. McBean, New York, N.Y.; H. M. Chance, Philadelphia, Pa.; A. Fasken, H. Armstrong, A. T. Struthers, Toronto.

The Annie Mining Co., Toronto, $40,000; D. D. McBean, New York, N.Y.; H. M. Chance, Philadelphia, Pa.; A. Fasken, H. Armstrong, A. T. Struthers, Toronto.

The Isa Mining Co., Toronto, $40,000; D. D. McBean, New York, N.Y.; H. M. Chance, Philadelphia, Pa.; A. Fasken, H. Armstrong, A. T. Struthers, Toronto.

The Annabella Mining Co., Toronto, $40,000; D. D. McBean, New York, N.Y.; H. M. Chance, Philadelphia, Pa.; A. Fasken, H. Armstrong, A. T. Struthers, Toronto.

The Louise Mining Co., Toronto, $40,000; D. D. McBean, New York, N.Y.; H. M. Chance, Philadelphia, Pa.; A. Fasken, H. Armstrong, A. T. Struthers, Toronto.

New Brunswick.—The Alexander Dunbar & Sons Co., Woodstock, N.B., $75,000; A. Dunbar, Sr., A. Dunbar, Jr., Andrew Dunbar, W. Dunbar, H. Dunbar, Woodstock, N.B.

Dominion.—The Beach Calculating Machine Co., of Canada, Montreal, $50,000; J. A. Laurin, O. Herbert, J. E. Poirier, H. Sauriol, O. Senecal, P. E. Lamarche, Montreal.

The Water Supply Co., Montreal, $40,000; M. Rousseau, Montmagny, Que.; A. E. Brunet, W. J. White, L. Rousseau, A. W. P. Buchanan, Montreal. To promote and organize companies for the supply of water and gas.

The Alberta Portland Cement Co., Toronto, $1,000,000; A. T. Malone, J. W. Mitchell, A. L. Malone, A. Mearns, J. A. Fraser, Toronto.

Dominion Engineering and Construction Co., Montreal, $100,000; V. E. Mitchell, E. Fabre, C. M. Cotton, J. W. Weldon, S. J. LeHuray, Montreal.

The Miramichi Quarry Co., Montreal, $90,000; R. A. E. Greenshields, A. W. G. Macalister, W. J. Henderson, A. C. Calder, W. D. Garland, Montreal.

Corrugated Steel Bar Company of Canada, Montreal, $50,000; G. E. Drummond, T. J. Drummond, D. S. Walker, J. T. McCall, Montreal; R. S. Lea, Montreal.

The Renaud Interlocking and Block System Co., Montreal, $250,000; L. A. Derome, J. Archambault, A. Dupuis, L. A. David, E. Renaud, R. Prefontaine, H. Dupuis, A. Dupuis, Montreal.

British Columbia.—The Western Hydraulic Mining Co., Vancouver, $150,000. To carry on mining, and deal in mining properties, etc.

Northern and B. C. Sampling and Milling Co., $20,000. To deal in mining properties.

The Forbes Hardware Co., Vancouver, $40,000. To carry on a general hardware business.

Beaver Valley Oil Co., Limited, $100,0000. To do a general mining business.

Manitoba.—The Canada Carb-ox Co. Winnipeg, $30,000; J. Stuart, J. N. Yeomans, W. Stephenson, Winnipeg; J. W. Hays, Chicago, Ill.; J. Graham, Winnipeg.

National Supply Co., Winnipeg, $200,000; A. H. Town, F. H. Welfley, A. T. Davidson, W. T. Crispin, E. L. Taylor, Winnipeg. To deal in all kinds of building materials.

The Great West Wire Fence Co., Winnipeg, $100,000; T. Black, W. A. Morkill, W. L. Belyea, W. M. Andrews, C. W. Bradshaw, Winnipeg.

Canada Traders, Winnipeg, $100,000; T. L. Metcalfe, F. E. Sharpe, G. A. Metcalfe, M. S. McLean, Richard R. Pattinson, Winnipeg. To build mills, elevators, etc.

W. C. Wilcox, Winnipeg, $200,000; W. H. Meneray, W. C. Wilcox, H. Veasey, T. Sharpe, G. A. Metcalfe, Winnipeg. To manufacture all kinds of tools and machinery.