PAGES

MISSING

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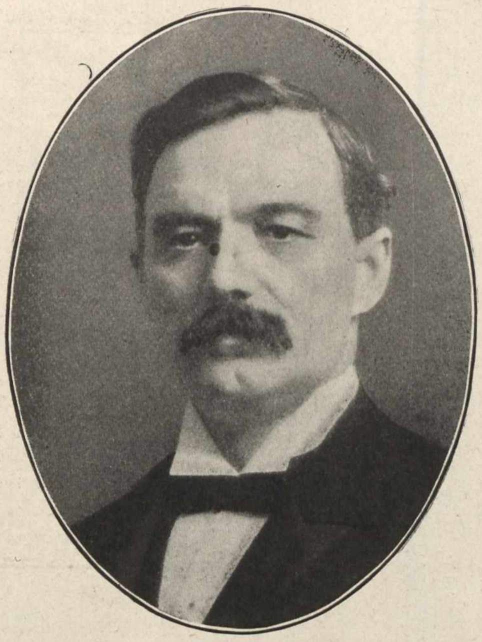
"We judge ourselves by what we feel capable of doing; but the world judges us by what we have already done."

*Longfellow.*



**J. A. JAMIESON, M.E.**

Member of American Society Civil Engineers, Member of Canadian Society Civil Engineers, Author of "Grain Pressures in Deep Bins."

Seeing that self-preservation is the first law of nature, and wheat the "Staff of Life," it is not surprising that both history and experience show that agriculture is the foundation of the material prosperity of nations. Witness the wonderful growth of the United States in the last decades of the nineteenth century, and the phenomenal rise of Canada at the dawn of the twentieth: in both cases largely due to the cultivation of immense areas of virgin soil on the broad wheat-growing lands of their Western prairies, which to-day are the granaries of the "Old World." But these natural resources would have been commercially useless had not the Civil and Mechanical Engineers, with their bridges, railways, locomotives and freight cars, come to the rescue of the hosts of inland farmers and myriad consumers across the sea. The magnitude of this traffic, however, has necessitated the invention of a new system of storage in the shape of Grain Elevators and Bins on such a colossal scale, and involving such a high order of skill and resource in design and construction, as to constitute an entirely new line of specialist Engineering.

The inception was American, but, "Engineering News," of New York, being witness, we have in Montreal to-day, a Canadian who is "the leading authority on the American system of 'Silos'"; and it is our pleasure this month to tell, briefly, the life story of this distinguished Engineer.

James Alexander Jamieson was born in Peterboro', Ont., 1860. While he was very young his parents removed to Cobourg, where he received his common and high school education. His technical training was gained, not in the halls of learning, but by hard study in the light of the midnight lamp, and by practical experience gathered in the engineering workshop. In this latter respect Mr. Jamieson is on the muster roll of an august company. As Samuel Smiles has shown in his "Lives of the Engineers":

> One of the remarkable things about engineering is, that its chief achievements have been accomplished not by natural philosophers nor by mathematicians, but by men of humble station—for the most part self-educated.——A wheelwright like Brindley; an attorney's clerk like Smeaton; a mathematical instrument maker like Watt; a millwright like Rennie; a working mason like Telford; a slater like Clement; or an engine brakesman like Stephenson.

. . . . . . . .

His first experience in the practice of Mechanical Engineering was gained in the office of his father, who was a mill designer and builder, and obtained his first knowledge of the line of business in which he has since become a specialist, on the construction of the Elevator at Midland, Ont. In 1882—then twenty-two—he entered the service of the C.P.R. on the Engineering staff in construction of the main line. In 1884, transferred to the T., G. and B. Division, C.P.R., on grain elevator construction at Owen Sound. From thence, in 1885, was transferred to engineering department, head office, Montreal, and four years later (1889) given charge of the designing and construction of elevators, followed by appointment as Superintendent of Elevators, and was largely responsible for the designing and building up of the extensive grain elevator system of the company. In 1896 he commenced private practice, and designed and built elevators at Prescott, Owen Sound, Fort William, St. John, N.B., Halifax, and Port Arthur, and is at present designing and superintending the construction of a 2,000,000 bushel fire-proof, transfer elevator for the Canadian Government at Port Colborne, at the entrance to the Welland Canal. This "modern" grain elevator, both as regards structural design and mechanical equipment, will, when completed, be superior to anything of the kind in existence. It will handle grain at a greatly reduced cost in comparison with existing systems, and reduce the time of discharging and loading vessels by nearly one-half. A special feature of this Elevator is, that not only is the structural work original in design, but all the mechanical appliances are the product of Mr. Jamieson's inventive skill, and are being constructed in accordance with his designs. In this respect it may be described as unique. We recently had the pleasure of critically inspecting Mr. Jamieson's office system, and, based upon thirty years' drawing office experience in England, United States and Canada, have no hesitation in saying, that for lucidity of arrangement and completeness of detailing—admirably suited to modern workshop needs—his system of designing and drafting is equal to anything being done on the American continent. One has only to glance at the diagrams, tables, and formulæ embodied in his classic paper on "Grain Pressure in Deep Bins," read before the Can. Soc. C. E., for which he was awarded the Gzowski medal, and which appeared verbatim in the columns of "The Canadian Engineer," April, 1904, to perceive the scientific precision and thoroughness of his work. It reveals the secret of his success.

It is the glory of Canada that among her sons are men like J. A. Jamieson, who, in the domain of Engineering, are making an international reputation; not by bubble advertising and graft, but by honorable dealing and a wise use of their powers, and in this way are aiding mightily the industrial development of their native land.

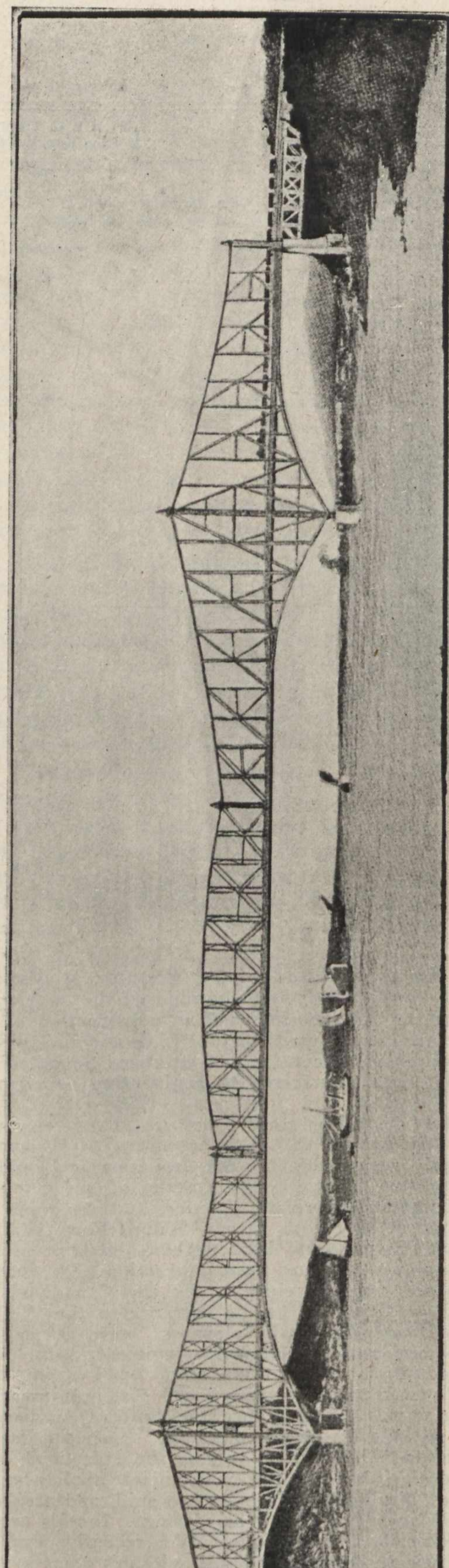


Fig. 1.
PANORAMIC VIEW OF BRIDGE AS IT WILL APPEAR WHEN COMPLETED.
(See page 331.)

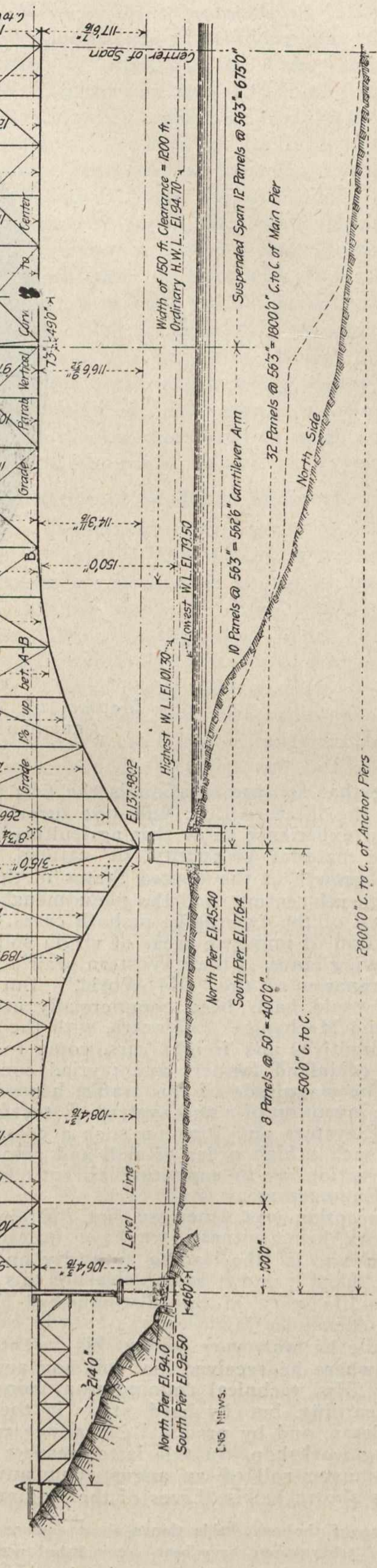



Fig. 2.
DIAGRAM OF HALF SIDE ELEVATION
(See page 331.)

# CANTILEVER BRIDGE, (1,800 FEET SPAN) ACROSS THE ST. LAWRENCE RIVER, NEAR QUEBEC, CANADA.

Since 1890 the Forth Bridge, Scotland, has stood unrivalled as the greatest girder span in the world—1710 feet. This pre-eminence, however, will soon be lost, for a cantilever bridge is now being erected across the St. Lawrence, with a main span 90 feet longer than that of the Forth Bridge. In the fine panorama view shown, Fig. 1, it will be seen that the bridge is of cantilever structure, the central span of which extends almost from bank to bank of the river, and is 1800 feet long from centre to centre of piers, with a central suspended girder 675 feet long and 130 feet deep at middle, connected at ends to cantilever arms 526 ft. 6 in. long, whilst the anchor spans are each 500 ft., and the approach spans 210 feet long.

It is designed to carry two lines of railway, two trolley lines, two highways and two sidewalks. The sidewalks are carried on the outside of the trusses by cantilever extensions of the cross girders. The balance of the traffic is carried between the trusses, which are placed 67 feet apart.

clearly the main characteristics of the structure. The clear headway provided is attained without an excessive length of approach viaduct and with a gradient not exceeding one per cent.

The height of the post over each river pier is 315 feet, corresponding to about 350 feet above the level of ordinary high water. This post is ten feet wide by four feet in depth, and rests at its lower end on a pin 24 inches in diameter. Pin connections have been used throughout, the usual size of the pins on the main and anchor spars being 12 inches, though, as stated, the main pins over the main piers are double this. The main eye-bars are naturally of exceptional dimensions, being generally 15 inches or 16 inches wide, and it is also proposed to use some 18 inches wide. The main cords are 54 inches deep and 68 inches wide; whilst the vertical posts measure from 40 inches to 48 inches in width, according to their situation. The cross-girders carrying the roadway are 10 feet deep. No castings

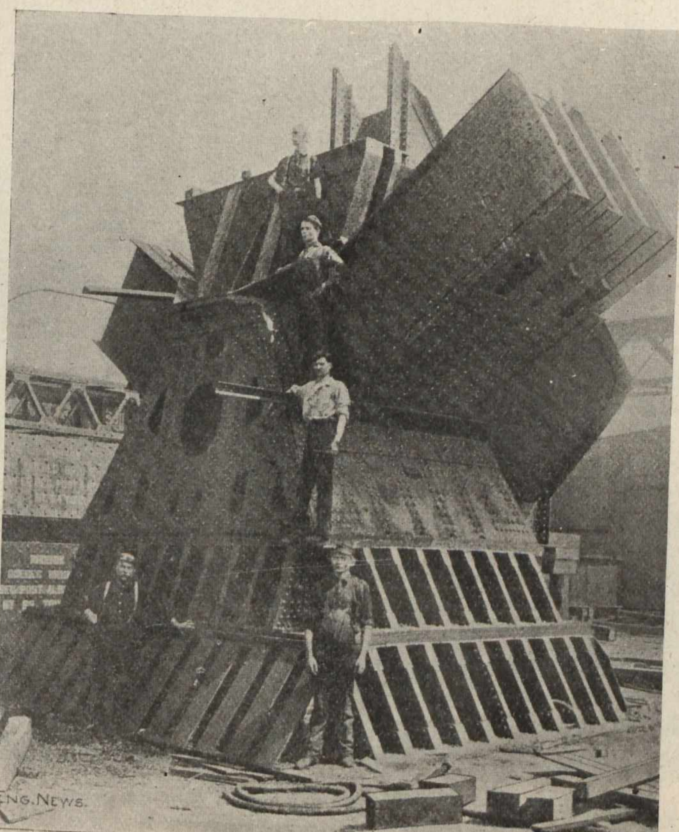



Fig. 3.—Main Connection Over Pier.

The bridge is being built for the Quebec Bridge and Railway Company, of which the Hon. S. N. Parent is president, and Mr. E. A. Hoare the chief engineer, whilst Mr. Theodore Cooper is acting as consulting engineer. The site selected is some six miles above Quebec, at a point where the river narrows to less than 2000 feet at low water. From this point up stream to Montreal, a distance of 165 miles, there is no bridge now existing, whilst below Quebec the river widens out so much as to make the bridging of the river below the city very improbable; so that this bridge will, when finished, be the only one between Montreal and the sea, a distance of nearly 1000 miles. It will afford direct connection between the Great Northern Railway of Canada, the Quebec and St. John Railway, and the Canadian Pacific Railway, on the one side, and the Grand Trunk Railway, the Intercolonial line and the Quebec Central Railway on the south side of the river. The bridge will also form a link in the projected Grand Trunk Pacific transcontinental line.

A diagram of half the main and the whole of one anchor span of the bridge is represented in Fig 2, which shows

are being used for any part of the bridge, even the main shoes and pedestals being built up of rolled plates and angles.

In Fig. 3 is represented the bearing for one of the river piers, with the pin-plates for the vertical and inclined members already in position. The total weight here represented is stated to be 537,000 lbs. The heavy weights and large dimensions of the pieces of the bridge has occasioned some trouble in transport. The false work for the erection of the south anchor is shown in Fig. 4. The central portion is of timber and will carry the floor of the bridge, over which materials will be delivered to the traveller. The outer portion is of steel, and is built in groups of four columns under each panel point, which are thoroughly braced together. At the top of these columns is fixed a steel floor, on which will be laid the lower chords of the bridge. The traveller shown in the extreme right is used for erecting the false work only, that to be used in the erection of the main structures being represented on the left. This latter "straddles" the bridge, and is carried on metal girders fixed on the false work in the case of the anchor spans, and in the case of the channel spans the traveller will run over heavy box girders suspended from the main pins of the permanent structure. This traveller is built of steel. It is 215 feet high, and is 100 feet wide at the bottom, with an over reach of 66 feet. It is fitted with four electric hoists, and will be able to handle easily weights up to 105 tons.

The railway approach to the bridge site was completed last July, and the traveller erected immediately afterwards, the first portion, the permanent metal, being put in place on July 22nd. On September 1st the main anchorage bent on the south side of the bridge, and all the lower chords and bracings of the south anchor arm, the main pedestal shoes over the main pier were in position, and the erection of the web members of the main truss was started early in the present month. Work will, however, have shortly to be suspended for the winter, as it is generally impossible at Quebec to carry on operations of this character between November 15th and April 15th. The work on the approaches and on the construction of the main piers was executed by Mr. M. P. Davis, of Ottawa, whilst the steel work is being supplied by the Phœnix Bridge Company, of Phœnixville, Pa.

[We are indebted to "Engineering," England, and "Engineering News," New York, for the data and illustrations embodied in the foregoing descriptive account.]

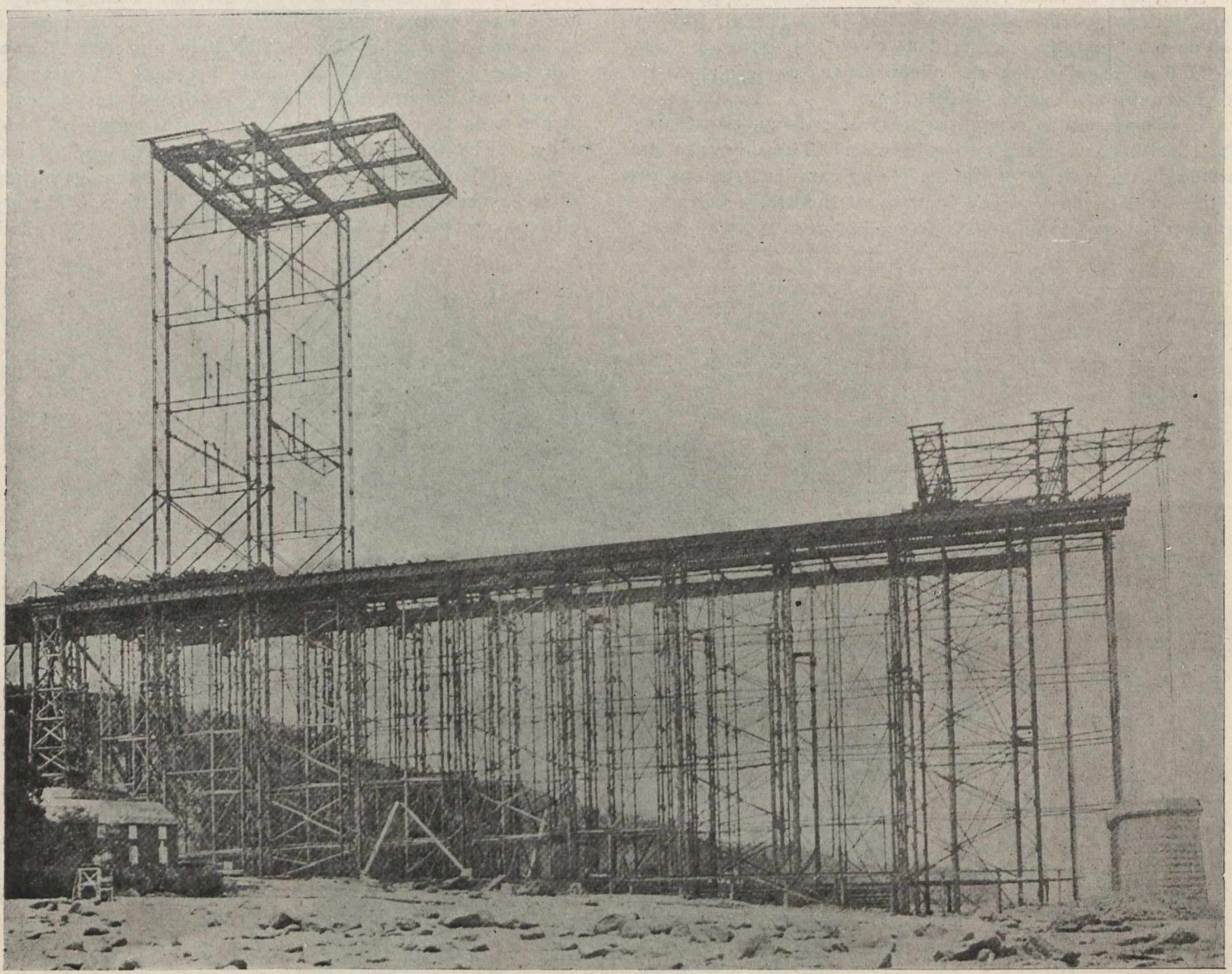


Fig. 4.—False Work over South Anchor Arm.

# SYSTEM IN INDUSTRIAL ESTABLISHMENTS

BY A. J. LAVOIE.

(Registered in accordance with the Copyright Act.)

## THE ORDER.

Before an estimate or "tender" is accepted, there is very often a considerable amount of correspondence between the customer and the Sales Agent. This is the most dangerous stage between the first enquiry, and final delivery of the goods. Oft-times the Sales Agent, eager to secure an order, will agree to changes in the figures of the estimate, or make inconsiderate promises as to delivery, which those responsible in the works find it almost impossible to carry out; causing no end of worry and trouble; and not unfrequently leading to costly litigation. When a physician gives you a prescription, you do not change it to suit the nurse or the druggist before consulting the physician; like precaution should prevail in industrial establishments. Before any alterations are made in the terms or conditions specified in a carefully prepared estimate or tender, the responsible Engineer should be consulted; for in making his estimate, he has incorporated practical advice gathered in the shops, supplemented by the wise experience of the Chief Engineer, Superintendent, and Managing Director; hence there is double safety in following his advice; based as it necessarily is, on actual practice, as well as experienced co-ordination of all the facts and conditions involved in the production of the work to be done.

When an estimate has been carefully prepared by the Estimating Engineer, it should be as unchangeable as the laws of the Medes and Persians, except with his consent, and right here, let me say something worth remembering. It is not the number of orders secured, which make for the prosperity of an establishment—pay dividends to the share holders, but it is orders secured at a price based upon care fully collected workshop data. In these days of keen competition, rule of thumb and guesswork practice in making prices and contracts should be avoided with as much caution as you would a live wire, or dangerous explosive.

When an order is secured, a form of contract is straightway prepared in triplicate by the Sales Division; the original being sent to the customer; the duplicate reserved for the Estimating Engineer, and the triplicate kept in the files of the Sales Office. This initial procedure is followed by the issue of a shop order in quadruple form; consisting of original form No. 22; duplicate form No. 23; triplicate form

No. 24; and quadruplicate form No. 25. The last-named is kept on file in the archives of the Sales Office; while the other three, No. 22, No. 23, No. 24, are attached to the duplicate copy of the contract, together with a cost sheet of all expenses relating to this contract—from the first enquiry. and including preparation of the estimate, to this point of readiness to deliver the shop order to the works.

On the upper part of form No. 60, the indicated path of travel shows that the shop order forms No. 22, No. 23, and No. 24, duplicate of contract, etc., bearing signature of sales manager, also date, hour and minute of issue, are transferred first of all to Dept. No. I., which signifies the managing director's office. By this plan, the managing director is kept posted on all contracts passing into the works.

SALES DEPARTMENT to the ENGINEERING DEPARTMENT

Form No. 22.* ● †ORIGINAL ● ORDER

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

Purchaser's Name and Address in full } ..............................

Order taken by our Agent Name and No. } .............................. Date .............. 190..

Date to be delivered .............................. (Contract No. ..............)

Terms of delivery .............................. (Purchaser's Order No. ..............)

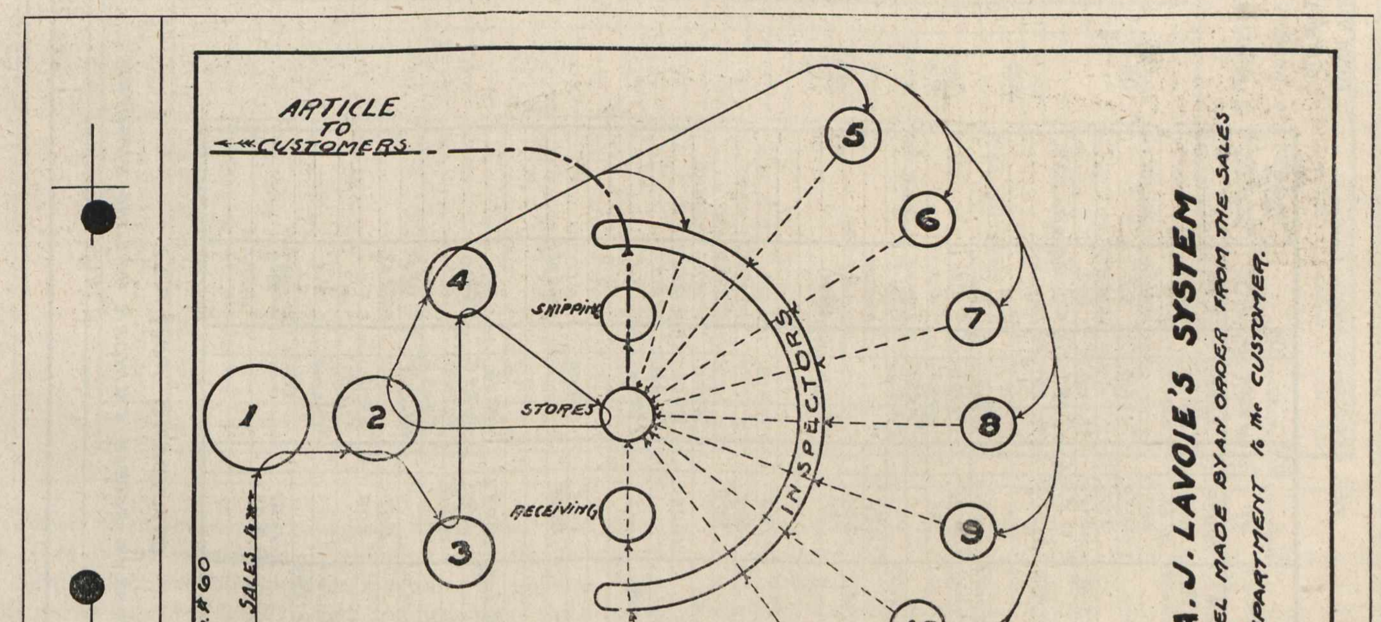
Shipped Via .............................. Date .............. 190..

| APPROVED BY | APPROVED BY | APPROVED BY |
|---|---|---|
| SALES DEPARTMENT | SUPERINTENDENT'S DEPARTMENT | ENGINEERING DEPARTMENT |

| SHIPPING LIST NO. | JOB NO. | ORDER NO. |
|---|---|---|
| | | |

* Change this number to No. 23 for the "Duplicate"; to No. 24 for the "Triplicate"; and to No. 25 for the "Quadruplicate."

† Change this name "Original" to "Duplicate" on Form No. 23; to "Triplicate" on Form No. 24; and to "Quadruplicate" on Form No. 25.




Let us now trace on the specially prepared chart, form No. 60, the path through which the shop order forms and attached accessories travel. It will be perceived that the name and color of the various departments have been omitted. This has been done with a view of avoiding confusion. The departmental number only has been placed within the respective circles. If the reader finds difficulty in remembering the names of the various departments, he has only to refer to form No. 59 on page 216.

Immediately upon receiving the shop order, etc., the managing director, or his representative should stamp date, hour, and minute it reached his office on back of all sheets. Then, having scrutinized the contents, should register his "O.K.," or, write any necessary remarks on the order form as a guide to the subordinate shop management. This having been done, No. 1, or his office representative, makes a copy of said remarks; then these notes together with sales office cost sheet are to be filed with estimate cost sheet

This space reserved for binding.

A.J. Lavoie's System. #96

| No. of Pieces | NAME OF ARTICLES | Drawing No. | List No. on drawg. | Pattern No. | Checked when patt. is made | Material | Weight Rough When finished Underline | Production List No. | Inspector |
|---|---|---|---|---|---|---|---|---|---|
| 2 | CONNECTING RODS | 12050 | | 9809 | | C. st. | | | |
| 2 | Crank Pin Boxes 2"x2½" | 1163 | | 10304 | | Bro. | | | |
| 2 | Crosshead pin Boxes 1½"x2½" | 1177 | | 10310 | | " | | | |
| 2 | " wedges | 130 | | | | Mild st. | | | |
| 2 | " " cap screws | 12050 | | #226.A. | | W.I. | | | |
| 2 | Crank Pin Wedges | 137 | | | | Mild st. | | | |
| 2 | " " " Cap Screws | 12050 | | #232.A. | | W.I. | | | |
| 2 | " " oilers | Catalogue #224 Fig. 650. ½" Pipe tap 2¼" d. | | | | | | | |
| 2 | " " adj bolts cotter pins | ⅛" split Cotter Pin. 7/8 long | | | | | | | |
| 1 | CROSSHEAD (right hand) | 12081 | | 10190 | | C.I. | | | |
| 1 | " (left hand) | 12086 | | 10190 | | C.I. | | | |
| 2 | covers | 171 | | 10195 | | C.I. | | | |
| 8 | " studs | | | #505.A | | W.I. | | | |
| 8 | " " nuts (standard) | | | ¾" Hex. nut. | | W.I | | | |
| 2 | Pins | 172 | | | | med. st. | | | |
| 2 | " Jam nuts (special) | 1235 | | | | | | | |
| 2 | Keys | 172 | | | | steel | | | |
| 2 | CRANK Discs | 198 | | 10219 | | C.I. | | | |
| 2 | Pins | 197 | | | | Med. st. | | | |
| 2 | " Covers | 199 | | | | Boiler plate | | | |
| 2 | " " Cap Screws | | | #401.A. | | W.I. | | | |
| 2 | shaft bearing caps | 12080 | | 10191 | | C.I. | | | |
| 4 | " " " studs | —— | | #619 A | | W.I | | | |
| 4 | " " " " nuts | | | ⅞ std. hex. | | W.I | | | |
| 1 | PINION | 195 | | 10206 | | C.I. | | | |
| 1 | Key (standard) | 1288 | | | | Mild st. | | | |
| 1 | THROTTLE VALVE body | 12087 | | 10286 | | C.I. | | | |
| 1 | Disc | 1141 | | 10288 | | Bro. | | | |
| 1 | Cover | 1223 | | 10349 | | C.I. | | | |
| 4 | " Studs | | | #403.A | | W.I. | | | |
| 4 | " " nuts (standard) | | | ⅝ hex. nut | | W.I | | | |
| 1 | Spindle | 1151 | | | | Mild st. | | | |
| 1 | " Gland | 202 | 1 | 8418 | | C.I. | | | |
| 2 | " " studs | | | #111.C. | | W.I. | | | |
| 2 | " " nuts, standard | | | ⅜ hex. nut | | W.I | | | |
| 1 | Drain Plug (Std. ¼" pipe Plug) | | | | | C.I. | | | |
| 1 | Spring | 1261 | | | | Brass wire | | | |
| | Arr'g't. except Hand lever & Quadrant | 12583 | | | | | | | |

PROPERTY OF **A.J. LAVOIE** STANDARD FOR ALL 7"x8¼"x10" DOUBLE CYLINDER HOISTING ENGINES

Drawing No. 200

This space reserved for binding.

FORM No 96
CUT No 1

A.J. Lavoie's System. #96

| No. of Pieces | NAME OF ARTICLES | Drawing No. | List No. on drawg. | Pattern No. | Checked when patt. is made | Material | Weight Rough When finished Underline |
|---|---|---|---|---|---|---|---|
| 2 | CONNECTING RODS | 12050 | | 9809 | | C. st. | |
| 2 | Crank Pin Boxes 2"x2½" | 1163 | | 10304 | | Bro. | |
| 2 | Crosshead pin Boxes 1½"x2½" | 1177 | | 10310 | | " | |
| 2 | " wedges | 130 | | | | Mild st. | |
| 2 | " " cap screws | 12050 | | #226.A. | | W.I. | |
| 2 | Crank Pin Wedges | 137 | | | | Mild st. | |
| 2 | " " " Cap Screws | 12050 | | #232.A. | | W.I. | |
| 2 | " " oilers | Catalogue #224 Fig. 650. ½" Pipe tap 2¼" d. | | | | | |
| 2 | " " adj bolts cotter pins | ⅛" split Cotter Pin. 7/8 long | | | | | |
| 1 | CROSSHEAD (right hand) | 12081 | | 10190 | | C.I. | |
| 1 | " (left hand) | 12086 | | 10190 | | C.I. | |
| 2 | covers | 171 | | 10195 | | C.I. | |
| 8 | " studs | | | #505.A | | W.I. | |
| 8 | " " nuts (standard) | | | ¾" Hex. nut. | | W.I | |
| 2 | Pins | 172 | | | | med. st. | |
| 2 | " Jam nuts (special) | 1235 | | | | | |
| 2 | Keys | 172 | | | | steel | |
| 2 | CRANK Discs | 198 | | 10219 | | C.I. | |
| 2 | Pins | 197 | | | | Med. st. | |
| 2 | " Covers | 199 | | | | Boiler plate | |
| 2 | " " Cap Screws | | | #401.A. | | W.I. | |
| 2 | shaft bearing caps | 12080 | | 10191 | | C.I. | |
| 4 | " " " studs | —— | | #619 A | | W.I | |
| 4 | " " " " nuts | | | ⅞ std. hex. | | W.I | |
| 1 | PINION | 195 | | 10206 | | C.I. | |
| 1 | Key (standard) | 1288 | | | | Mild st. | |
| 1 | THROTTLE VALVE body | 12087 | | 10286 | | C.I. | |
| 1 | Disc | 1141 | | 10288 | | Bro. | |
| 1 | Cover | 1223 | | 10349 | | C.I. | |
| 4 | " Studs | | | #403.A | | W.I. | |
| 4 | " " nuts (standard) | | | ⅝ hex. nut | | W.I | |
| 1 | Spindle | 1151 | | | | Mild st. | |
| 1 | " Gland | 202 | 1 | 8418 | | C.I. | |
| 2 | " " studs | | | #111.C. | | W.I. | |
| 2 | " " nuts, standard | | | ⅜ hex. nut | | W.I | |
| 1 | Drain Plug (Std. ¼" pipe Plug) | | | | | C.I. | |
| 1 | Spring | 1261 | | | | Brass wire | |
| | Arr'g't. except Hand lever & Quadrant | 12583 | | | | | |

PROPERTY OF **A.J. LAVOIE** STANDARD FOR ALL 7"x8¼"x10" DOUBLE CYLINDER HOISTING ENGINES

Drawing No. 200

No. 106, already in his office. Everything else should be at once despatched to No. 2. *It is the conventional right of No. 2 to accept or reject any order emanating from the Sales Division, since he is responsible for the orderly and economic operation of the works.* Upon receiving the order and its accessories from No. 1, No. 2, or his secretary, must also stamp on back of all the sheets, date, and time they reached his office. The same operation to be repeated upon issue or rejection.

In the event of rejection, an explanatory report must be made in triplicate; the original being retained in his office; the duplicate sent to department No. 3, and filed in envelope No. 90 relating to said order, if any estimate has been made, but if not, then filed alphabetically under customer's name until called for; the triplicate to be attached to the order and its accessories, and without delay returned to the Sales Division through the channel it came.

If, on the other hand, the Order is accepted by No. 2, it is his province to supplement the data on Order form, with any information or instructions he may deem necessary to expedite the production of the work. This done, the Order and allied parts are delivered to Department No. 3, and the index clerk in the department straightway stamps the back of all sheets with date and time of receipt. Having performed this routine operation, the index clerk passes the Order, etc., on to the Chief Engineer, who, after examining same, takes envelope form No. 90, places therein all additional data relating to this particular job, and forwards same to the Estimating Engineer for verification; to see if the Order has been secured in accordance with the specified conditions and figures set forth in the original estimate. If the Order has been taken and contract made on terms other than those specified in the estimate, the Estimating Engineer must note the difference; instantly prepare a report in duplicate, have this report approved by the Chief Engineer, place the original of his report in envelope No. 90 for retention in the files of Department No. 3, then despatch duplicate of report to Department No. 2; who will advise what course is to be pursued.

On the other hand, if the Order has been secured in accordance with the original estimate; then, with the Order and duplicate of contract in the hands of the Engineer who prepared the estimate, we have reached a stage where the advantages of the Lavoie System for Industrial Establishments, will be strikingly apparent, even to the most sceptical.

Having prepared in detail, estimate forms; instructive cards, and all necessary drawings or sketches relating to this particular job, none is better fitted to make an elaborate specification and inventory of every part of the machine structure or article to be manufactured, than the Engineer who prepared the estimate, hence to him is relegated this important duty. For this purpose, a standard specification form No. 96 has been introduced, upon which is to be entered every item or part, no matter how large or small; whether made in the shops or ordered out; together with a clearly defined statement of all material to be used in the making and construction of the said machine, structure or article.

A reference to the standard specification form No. 96, will show, that under the general term or caption, "connecting rod," are detailed all the parts necessary to make up a complete connecting rod; each item having a line relegated to it, and hence while keeping it in its class, making each part perfectly independent.

When detailing a machine or appliance, if several sheets are required, it is a manifest advantage to group on each sheet, standard parts which may be utilized over and over again. For example, the connecting rod, crosshead, crank pin, and throttle valve are always used on a 7 x 10, or 8¼ x 10 Hoisting Engine, hence the convenience of concentrating these parts on a sheet by themselves. A 7 x 10, or a 8¼ x 10 cylinder can be dealt with in like manner. The same rule applies to certain sized hoisting drums, and so on.

A.J. Lavoie's System. #96 — This space reserved for binding. — FORM No. 96 — CUT No. 2.

| No. of Pieces | NAME OF ARTICLES | Drawing No. | 1st NS. Group on drg. | Pattern No. | Checked when Patt'n is made | Material | Weight Rough When finished Underline | COST OF MATERIAL | COST OF LABOR | TOTAL COST. |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | CONNECTING RODS | 12050 | | 9809 | | C. st. | | | | |
| 2 | Crank Pin Boxes 2"x2½" | 1163 | | 10304 | | Bro. | | | | |
| 2 | Crosshead pin Boxes 1½"x2½" | 1177 | | 10310 | | " | | | | |
| 2 | " wedges | 130 | | | | Mild st. | | | | |
| 2 | " " cap screws | 12050 | | #226.A. | | W.I. | | | | |
| 2 | Crank Pin Wedges | 137 | | | | Mild st. | | | | |
| 2 | " " " Cap Screws | 12050 | | #232.A. | | W.I. | | | | |
| 2 | " " oilers | Catalogue | | #224 Fig | | 650. ½" Pipe tap 2½" d. | | | | |
| 2 | " " adj bolts cotter pins | ⅛" split | | Cotter Pin. | 7/8 | long | | | | |
| 1 | CROSSHEAD (right hand) | 12081 | | 10190 | | C.I. | | | | |
| 1 | " (left hand) | 12086 | | 10190 | | C.I. | | | | |
| 2 | covers | 171 | | 10195 | | C.I. | | | | |
| 8 | " studs | | | #505.A | | W.I. | | | | |
| 8 | " " nuts (standard) | | | ¾" Hex. nut. | | W.I | | | | |
| 2 | Pins | 172 | | | | med. st. | | | | |
| 2 | " Jam nuts (special) | 1235 | | | | | | | | |
| 2 | Keys | 172 | | | | steel | | | | |
| 2 | CRANK Discs | 198 | | 10219 | | C.I. | | | | |
| 2 | Pins | 197 | | | | Med. st. | | | | |
| 2 | " Covers | 199 | | | | Boiler plate | | | | |
| 2 | " " Cap Screws | | | #401.A. | | W.I. | | | | |
| 2 | shaft bearing caps | 12080 | | 10191 | | C.I. | | | | |
| 4 | " " " studs | | | #619 A | | W.I | | | | |
| 4 | " " " " nuts | | | ⅞ std. hex. | | W.I | | | | |
| 1 | PINION | 195 | | 10206 | | C.I. | | | | |
| 1 | Key (standard) | 1288 | | | | Mild st. | | | | |
| 1 | THROTTLE VALVE body | 12087 | | 10286 | | C.I. | | | | |
| 1 | Disc | 1141 | | 10288 | | Bro. | | | | |
| 1 | Cover | 1223 | | 10349 | | C.I. | | | | |
| 4 | " studs | | | #403.A. | | W.I. | | | | |
| 4 | " " nuts (standard) | | | ⅝" hex. nut | | W.I | | | | |
| 1 | Spindle | 1151 | | | | Mild st. | | | | |
| 1 | " Gland | 202 | 1 | 8418 | | C.I. | | | | |
| 2 | " " studs | | | #111.C. | | W.I. | | | | |
| 2 | " " nuts, standard | | | ⅜" hex. nut | | W.I | | | | |
| 1 | Drain Plug (Std. ¼" pipe Plug) | | | | | C.I. | | | | |
| 1 | Spring | 1261 | | | | Brass Wire | | | | |
| | Arr'g't, except Hand lever & Quadrant | 12583 | | | | | | | | |

PROPERTY OF A.J. LAVOIE — STANDARD FOR ALL 7 & 8¼" x 10" DOUBLE CYLINDER HOISTING ENGINES — Drawing No. 200

A complete Hoisting Engine, with say 14 x 28 Friction and Brake drum, and 42 x 90 Boiler, will take a series of specifications as follows:—(*a*) One "part list," which will be "standard" for all; (*b*) one for steam cylinder and its parts; (*c*) one for Drum and its parts; (*d*) one for the Boiler and its parts; (*e*) and one described as "miscellaneous," since it covers or contains all the *odd* things necessary to complete the engine; but liable to change when used in making combinations.

Cogent reasons can be given for the grouping of parts (1) to avoid the making of a working or part list on individual drawings subject to change, and where the constant erasure and alteration to suit varying conditions causes unsightliness, confusion, and oft-times serious error.

A glance at form No. 96 will show that the drawing number changes with every item on the part list. Now were these grouped details localized on their respective drawings only, it would be necessary to make elaborate notes thereon, indicating the connected parts and article of which it is a part. Consequently, if change in design and number of parts is made on any individual drawing, this will necessitate changes and revision on all the allied drawings in order to avoid confusion and error.

The superlative advantages of this *grouped* part list system must be obvious, since every part connected with a specified article is on one sheet only. Several drawings may be changed, but these alterations affect only one part list; a conservation of time, energy, and good temper which will appeal to every experienced manager of a factory.

(2) It is advantageous when the carrying of stock is found necessary. (3) Aids the assembling floor in the shops, by enabling the machine builder to readily assemble the respective parts. (4) Accustoms the manufacturing staff, to a uniform part list having parts grouped under general headings, and accompanied by number of respective drawings; thus greatly accelerating the finding of parts. (5) Enables the Stores Department to carry finished and assembled stock articles, ready to make combinations on rush orders. (6) Gives the detailed cost of a complete unit, finished article, prepared part, or single piece, which is filed upon the completion of each; thus enabling one to find the cost of each finished part or piece, as the general work progresses; and in this way, greatly facilitates the getting out of the total cost sheet. (7) Lucidly records on the Inspector's part lists the history of every piece; which is an unerring guide in the event of future repair or duplication.

A. J. LAVOIE'S SYSTEM No. 26. PRODUCTION DEPARTMENT No. 4.

GENERAL STORE REQUISITION FOR PURCHASED MATERIAL

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

To Purchasing Office, Date..........190...., Prepared by..........Store Keeper

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

PURCHASING OFFICE, DO NOT ORDER ANYTHING BEFORE IT IS APPROVED BY..........SUPERINTENDENT DATE,..........190...

*GENERAL STORE REQUISITION No.

| Nos. of Pieces | | | Name and Description of Articles | Bought From | | | Price for All | | Purchasing Office Order No. | Date Ordered | Date Received | Job No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-quired | Mini-mum | Maxi-mum | | Cata-logue No. | Figure No. | Article No. | $ | c. | | | | |
| | | | | | | | | | | | | |

Printed Blue on 20 lbs. Bond Paper, Padded on top only. *Numbered in Triplicate from last number furnished.

A. J. LAVOIE'S SYSTEM No. 27. PRODUCTION DEPARTMENT

GENERAL STORE REQUISITION

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

To Production Office, Date..........190...., Prepared by..........Store Keeper

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

PRODUCTION OFFICE, DO NOT ORDER ANYTHING BEFORE IT IS APPROVED BY..........SUPERINTENDENT DATE,..........190...

*GENERAL STORE REQUISITION No.

| Nos. of Pieces | | | Name and Description of Articles | Drawing No. | Pattern No. | Mate-rial | Weight of one | Check Ordering | Check Completed | Production List No. | Job No. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Re-quired | Mini-mum | Maxi-mum | | | | | | | | | |
| | | | | | | | | | | | |

Printed Blue on Pink Bond or Linen Paper, 30 to 40 lbs. *Numbered in triplicate from last number furnished.

After the standard specification form No. 96, has been prepared on tracing cloth, if "standard," or, on thin tracing paper if "special," a blue print off same is to be made as illustrated on changed form No. 96, marked at top "cut No. 1;" which is made by inserting a blank strip of red paper between the tracing and the blue print paper, held by a paper clip at each end. The blank space on cut No. 1 is then ruled and headed by the Engineer in charge of the job, for the convenience of the Cost Department No. 4. A full set of these prints—as many as are required for the full complement of the parts of the machine—are to be placed between two sheets of 100 lbs. jute tag manilla paper, fastened on the upper end by wire staples, so that the forms can not be easily removed therefrom and lost.

The Cost Department No. 4, being supplied with a full set of part lists (form No. 96) has no excuse if the cost of the whole job is not complete.

Two additional sets of blue prints, form No. 96, one of which is to be placed in the hands of the Inspectors on the assembling floor of the shops, on which should be marked or indicated everything which has not been made in accordance with the approved drawings and specifications.

After the machine or article has been shipped off the works, the Inspectors' part lists are to be returned to the Engineering Department No. 3, where they must be carefully filed by the index clerk in envelope form No. 90, under the particular job number, and this rule should be rigidly enforced, that no part or piece required for this job, can be ordered until the Inspectors' part lists on file have been examined.

The remaining set of blue print forms No. 96, are to be forwarded to Department No. 4, where the date, and time of receiving same, should be stamped on back of each sheet. Department No. 4 will transfer these part lists to the Stores Department to be checked; and the stores official checkmark registered under the word "Inspector" next any of the specified articles, which they have in stock, whether in the rough or finished, and a number of articles so marked, entered straightway on Stores Record Card form No. 34 and No. 35; care being taken, that the job number and quantity required (the date and workmen's check number to be filled in only after the respective articles are delivered). If the balance of articles in stock is less than the minimum required, (which is determined by the Engineer in charge of the job), then Requisition form No. 26 or No. 27, (depending upon the character of the article), must be made out by Stores Department without delay. (Continued.)

# MOULDING A LARGE GEAR WHEEL.

BY THE EDITOR.

In no branch of the art of founding is there demanded of the moulder more skill, patience, resource, and intelligent perception of the laws of cause and effect than in the moulding of a 12 ft. double helical split gear, weighing some 12 tons, in which the pitch diameter and depth of face must not appreciably vary, the teeth be equidistant, and so clean that neither file, hammer nor chisel must be used on the flanks of any of them; and yet with properly designed machines and experienced artisans it is possible to approximate to this degree of perfection.

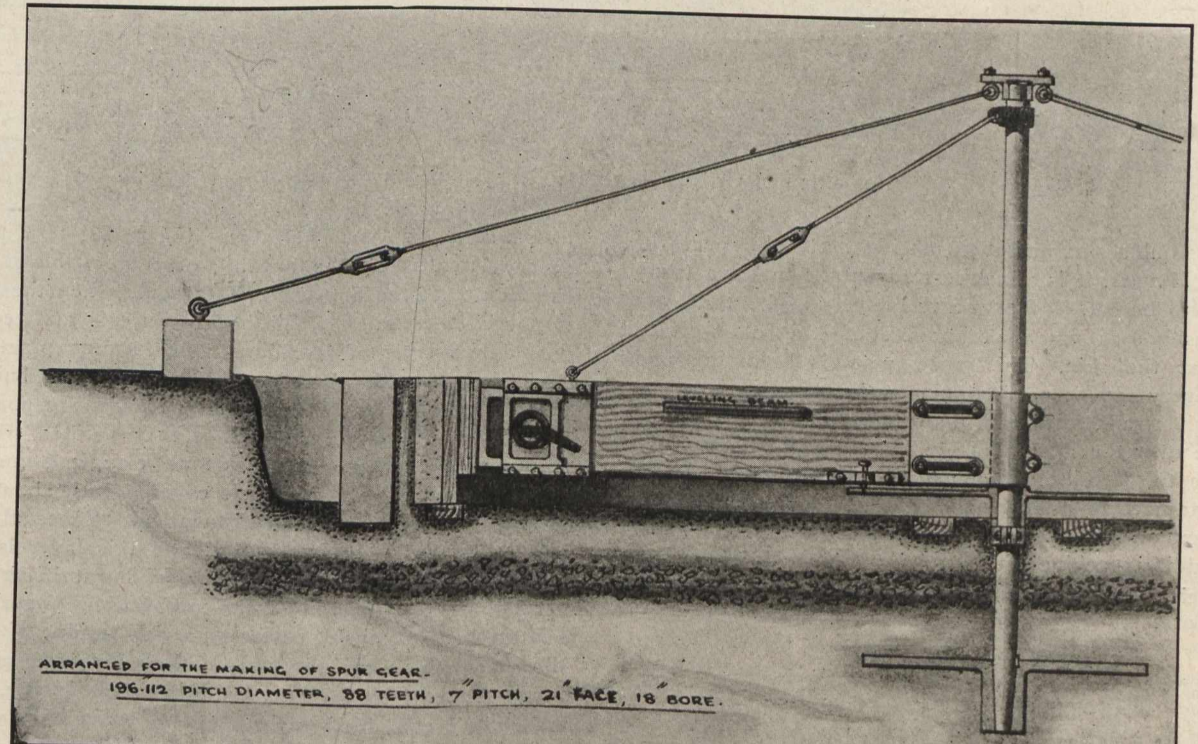



Fig. 1.—Groves' Portable Gear Moulding Machine.

Notwithstanding the manifest advantages of machine moulding it is astonishing to find how tenaciously some people cling to the antiquated. Sometime ago we visited the foundry of a large engineering concern and to our amazement saw them moulding a gear wheel about 6 ft. in diameter from a full pattern. The foundry floor was used for the drag, and just as we were passing, four men—each with one hand on the sling chain, shaking, and the other with a bar vigorously rapping the top of a spike driven into the water-soaked pattern—were trying to hoist the pattern out of the sand with the aid of a crane. When it was finally lifted out, a sorry plight the mould presented, for in several parts, the sand forming teeth spaces had been carried away with the pattern, and these defects in the mould had to be made up again by patching. One has only to witness this antedeluvian method of moulding to realize how it is that large gears made from costly full patterns are almost invariably irregular in form, defective in pitch, and when in gear touch only on one side of the face. In view of the increasing perfection and refinement in modern machinery, it is not surprising that the cut gear has almost entirely displaced the old uncouth cast gear with uncut teeth. But just as an axe is better than a razor to cut down a tree, so, in the fitness of things there are innumerable cases where the moulded-tooth gear is preferable to the gear with cut teeth. In machinery where the shaft centres seldom vary, the cut gear, with its deadly accuracy of pitch is manifestly the best; for as long as the gear centres remain intact the wear on the teeth will be practically nil, since in accordance with the laws of mechanics the teeth will roll on the pitch circles and not grind. On the other hand, in machinery subject to intense stress and violent shock—rolling mill, stamp press machines, etc.—the bearings wear away rapidly, the gears loose their centres, the teeth begin to grind instead of rolling, and the tale of woe is soon told: broken teeth and costly stoppage of plant. Now in gears where the grinding of gear teeth is inevitable, even in the best machines—due to unavoidable natural causes—gears with uncut teeth are immeasurably superior to cut teeth, because the skin of fine uncombined carbon left on the teeth of the moulded gear offers a much better wearing surface than does the coarse grain forming the surface of the cut teeth, from which the hard skin of combined carbon has been removed. The only advantage of cut gears is, guaranteed accuracy of pitch. Experience has demonstrated, however, that while machine-moulded gears may not be perfectly adapted for clock-work, yet for all practical purposes, as applied to mill and mining machinery, they are even superior to cut gears, since they not only are practically accurate as regards pitch, but are superior in the matter of resistance to wear and tear: due to their retention of the hard skin of combined carbon. But even where it is proposed to make large gears to have cut teeth, machine-moulding is the better way, for instead of casting a double rim, and then cutting the tooth spaces out of the solid mass, it is a manifest advantage to leave around the teeth to be cut, a film of metal, say ⅛ in. thick, and thus conserve as much as possible of the close-grained metal next the skin. This wise plan is becoming more popular every day. And recognizing that the day is not far distant when rail, beam, and plate mills will be dotted here and there over the Dominion, we have deemed it an opportune time to describe some experiences gathered in the actual manufacture of large machine-moulded gears.

A common laborer can be soon trained to operate a fixed gear moulding machine with revolving table, similar to Fig. 3—for which, when he has once made successfully, a spur, bevel helical worm wheel, the process in each subsequent case is very similar, and the man becomes practically part of the machine. When, however, we come to the machine moulding of heavy wheels over 6 ft. diameter—which must be made in the floor, and not on a table machine for fear of injuring it as an instrument of precision—then we are confronted with an altogether different condition of things. The common laborer is no longer available; the moulder must be, in every sense of the word, a mechanic. Take, for example, a double helical gear 14 feet diameter 4½-inch pitch, made in halves by means of splitting plates.

In the first place an excavation is made in the foundry floor, say about 7 ft. deep, and suitable anchor foundations laid thereon, with hooked bolts, secured in same. These anchor foundations are then covered with old sand, firmly tucked in, so that there is a 7 or 8-inch layer of hard-rammed sand over all, the only evidence of what is below being the large circle of anchor bolts standing up out of the floor. On this hard bed is laid a 7-inch layer of coke, in which is inserted at suitable points near the edges of the bed, a series of 4-inch pipes (see Fig 5) for carrying off the gases generated by the burning of combustible material in the facings at the bottom of the mould when the hot metal is poured therein. On this bed of coke is rammed another 7 or 8-inch layer of moulding sand, forming practically the base of the mould. A 14-inch brick wall is then built around the pit—care being taken that these bricks are porous. The inner face of this porous wall is then painted with water, thickened with common aluminous clay, and immediately, this moist clay wash-coating is covered with about 3 inches of coarse moulding sand—known as "Zanesville"—mixed plentifully with molasses water; and this layer is straightway covered with a thin coating of burnt black sand on account of its freedom from combustible organic matter, and at the same time possessing a rich residue of refractory silica. These preliminary preparations having been made, a heavy 36-inch base plate, with tapered socket, is firmly tucked and embedded in the centre of main foundation (Fig. 5), and a 4-inch sweep spindle inserted therein, braced with adjustable tie rods, radiating from cap on top to heavy weights sunk in foundry floor. This spindle is fitted with swinging arm, provided near the inner end, with pin for spacing teeth in index plate below (Fig. 2), and at the outer end with eccentric draw-back device, on which is fixed the tooth block, having the form of one tooth space. The perfect horizontality of the arm is regulated by a rod connected to spindle cap and end of extension arm, provided with adjusting turnbuckle, as shown (Fig. 1.). A laborer operates the drawback machine and indexing device, inside the ring, under the direction of the skilled moulder who stands in the space outside the wall, with a bucket of facing-sand by his side, leans over the wall, and with a rod of iron in one hand, and sand in the other, feeds and rams the space in the tooth

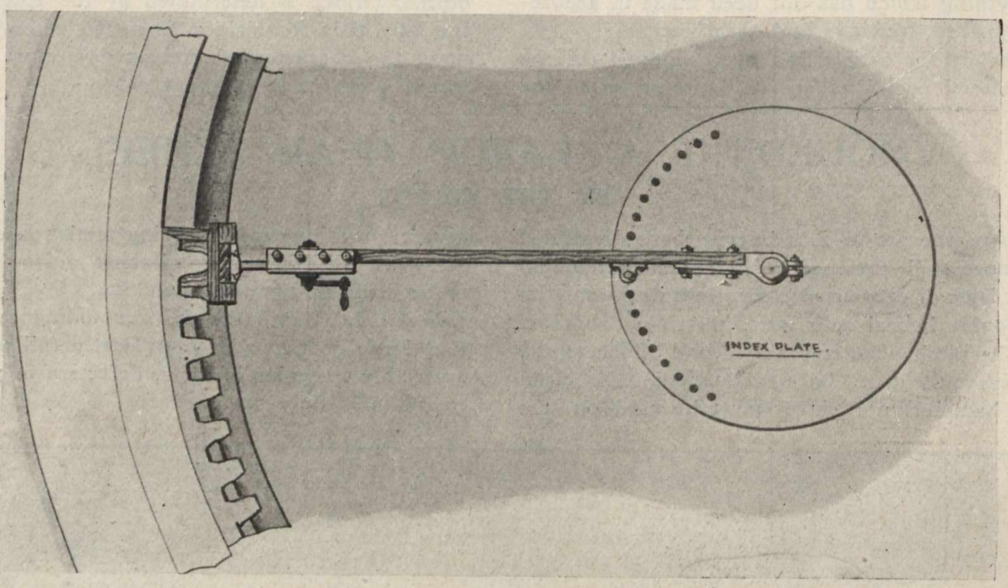


Fig. 2.—Plan of Groves' Portable Gear Moulding Machine.

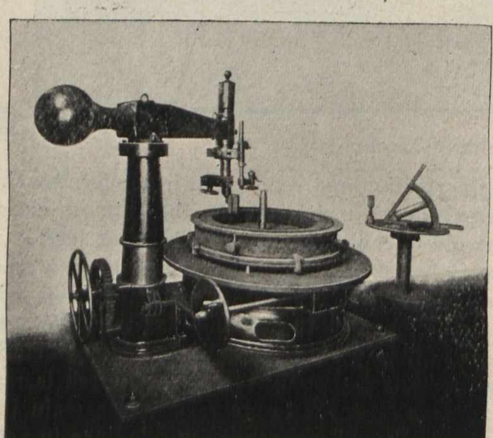


Fig. 3.—Universal Gear Moulding Machine. (Groves' Patent.)

block. When this space has been filled the laborer takes hold of the drawback handle, makes a complete revolution, and the tooth-space pattern is withdrawn clear of the moulds. This done, he lifts out the index pin, pushes the extension arm forward, drops the pin into the next hole in the index plate, takes hold of the drawback eccentric handle again, thrusts the tooth block up against the black sand backing once more, and the moulder commences to rain another tooth-space, and so on, until the whole circumference of teeth mould spaces are completed. Simple though

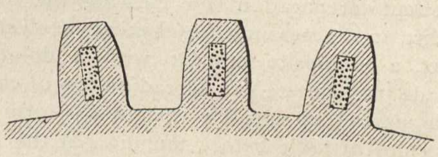


Fig. 4.—Mode of Venting Gear Teeth.

this work seems, it demands all the skill and resource of an experienced moulder, for, in selecting his facings, several important conditions have to be observed. The fine grained sands which he used for 1-inch pitch will not do for teeth 4½-inch pitch, the particles of silica in the sands must be coarser in order to render the facings porous, and thus allow for the free exit of the gases; it must be sufficiently cohesive to mould well and resist pressure, and sufficiently refractory to prevent the burning action of the hot metal. Further, the moulder, in ramming the teeth, must be able to judge exactly the necessary degree of force to impart to his rammer; the force applied in forming the tooth spaces for 1-inch pitch will not do for the larger sizes; and besides, the ramming must be uniform, since a hard spot here and a soft spot there, will tell its miserable tale when the gear is lifted out of the sand, either in unsightly scabs or ugly swellings, necessitating the use of hammer and chisel. And I may remark here that in moulding the teeth of large gears of 3-inch pitch and upwards, it has been found necessary to vent the mould of each tooth space, by leaving an oblong hole in the middle (Fig. 4), which is connected to the coke bed below by a vent wire and filled with fine particles of coke. Teeth moulds formed in this manner afterwards coated with a refractory solution, and thoroughly skin dried, not by the erratic heat of a coal or coke fire, but by a steady, regulated gas flame delivered through a 1¼-inch pipe, about 12 inches less in diameter than the mould and perforated with holes a few inches apart; so arranged, that the flame does not play on the face of the mould. With the mould made and dried thus, teeth can be produced with sharply defined edges and flanks bright, smooth and clean.

Another important improvement in manufacture is the substitution of green sand for dry sand arm cores. This is one more instance of necessity being the mother of invention.

If a large gear is to be true in diameter, there must be no resistance to general shrinkage. The shrinkage which takes place in the arms towards the hub must be followed by the rim between the arms also; anything which hinders this onward movement is detrimental to the diametral perfection of the gear. Hard-earned experience has proved that this is just what dry sand cores are found to do: hinder normal shrinkage. I well remember a deplorable instance of this. It was a large gear, 7-inch pitch 30-inch face, and when cast, a number of teeth were cracked transversely across the face, midway between the shrouds. The use of dry sand cores was manifestly the main cause of this mishap, for the arms were of I section, and as the metal in the top and bottom flanges shrank in towards the hub, it naturally drew the rim and whole face of the gear with it; but the hard dry sand cores resisted this, hence the metal in the teeth opened out in the middle. From that time forth I discarded dry sand cores, using only hollow, coke-filled green sand cores, made of coarse gravel or gum sand; and in no instance was the old trouble repeated, for they adjusted themselves to the shrinkage of the environing metal.

Having described and illustrated the method of forming the teeth moulds, selecting facings, and making the green sand arm cores, we now pass on to the question of covering in. In casting a heavy gear it is important that there should be no strain; the slightest uplift of the cope would cause the width of the face to vary and the gear to run untrue. With this danger in mind the modern gear founder has entirely discarded flexible wooden copes, as they are always liable to twist in lifting and bulge under pressure. Ponderous iron copes have also been abandoned, both on the score of expense and difficulty in handling. The best makers now use strong, dry sand covering cores exclusively—used after the manner indicated in Figs. 5 and 6. This system of cover cores represents a manifest advance in the art of moulding large gears; it is safe, economical and expeditious.

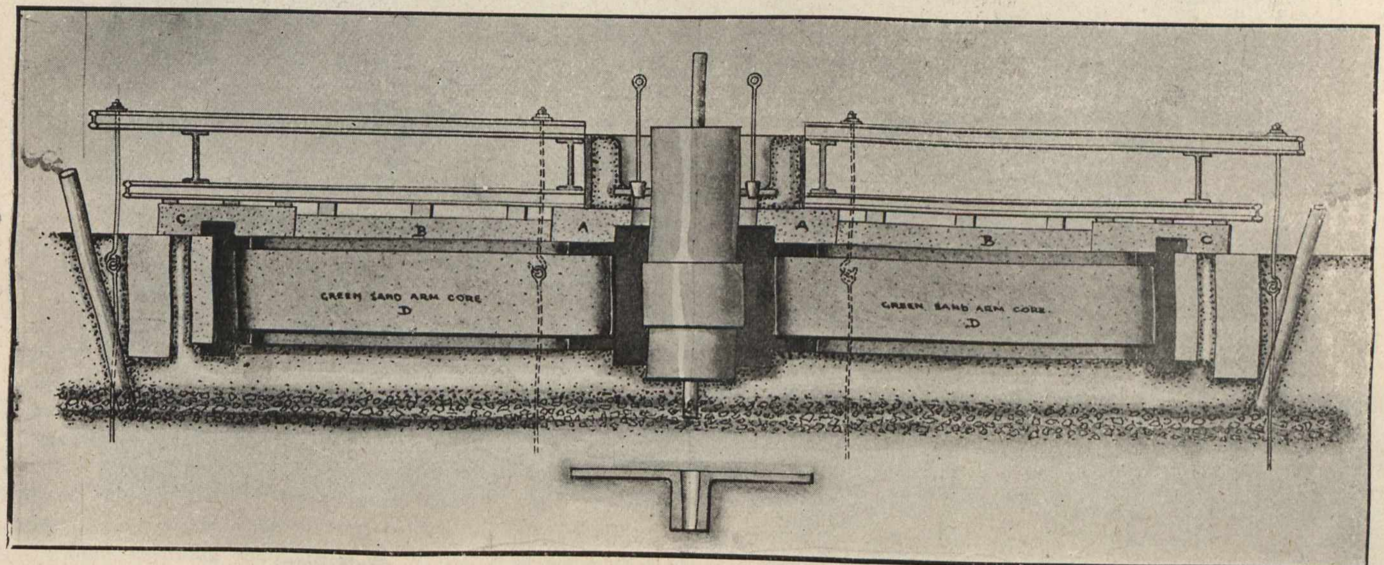



Fig. 5.—Section of Mould: Ready for Casting.

Again, not only is it important that the gear founder should have an accurate analytical knowledge of the properties of available moulding sands, in order to formularize suitable mixtures to suit the varying magnitude of the castings to be made; but should be acquainted with the refractory qualities of the various facings on the market; and, if need be, should have a few old-fashioned wrinkles up his sleeve, to bring out when occasion demands. Well do I remember such an occasion. A heavy casting had been made, with a skin the sight of which was enough to turn one grey with fright. A moulder of the "old school" suggested that a certain proportion of fire clay should be mixed with the facing. It was done and the skin on the next heavy dynamo field produced, was a joy to any moulder who takes a delight in his work.

For a like reason to the foregoing, the maker of machine-moulded gears should have a sound knowledge of metallurgy, so as to be able to select his metals by chemical analysis. The metal for a gear should be as close grained as possible, especially in the teeth, since a skin of fine grained combined carbon, offers the best wearing surface, yet must not be chilled, as in many cases the shrouds must be turned, hub-bored and key-seated in the machine shop, hence must not be too hard for the tool.

A metal mixture containing 2 to 2.5 per cent. of silicon would be suitable for a gear 1-inch pitch, but would be useless for a gear 7-inch pitch; in which the mixture should contain an average of about 1.25 to 1 per cent. of silicon.

The following table may be taken as a good working guide in the selection of suitable metal mixtures for average thicknesses:—

**** Grading of Metal Mixtures According to Thickness.**

| | Sil. | Man. | Phos. | Sul. | Remarks. |
|---|---|---|---|---|---|
| ¼ | 3.25 | .40 | 1.00 | .000 | |
| ½ | 2.75 | .40 | .80 | .025 | Note.—A casting |
| ¾ | 2.50 | .50 | .75 | .030 | to machine well |
| 1 | 2.00 | .60 | .70 | .040 | should not contain |
| 1½ | 1.75 | .70 | .65 | .050 | more than |
| 2 | 1.50 | .80 | .60 | .060 | 0.50 of combined |
| 2½ | 1.25 | .90 | .55 | .065 | carbon. |
| 3 | 1.00 | 1.00 | .50 | .070 | |

Another condition worth noting is, that if the casting is to be sound and the teeth sharply defined, the metal poured into the mould must be *hot.*

With lively metal the gases generated in the mould can be easily expelled, and owing to its fluidity shoots quickly out of the hub, along the arms, into the rim and teeth around the circle, filling every nook and corner in the mould, and producing teeth with the knife edge appearance which the gear moulder likes to see.

An excellent preparation for clearing the metal from scoria and dirt and increasing the chances of clean castings is Kirk's flux, a composite powder with a dolomite base, which we made into a paste and spread on top of each charge in the cupola, as well as sprinkle (in powder form) over the bottom and sides of ladle before tapping out the hot metal. This composition causes the metal to boil, throwing the scoria—which is of lighter specific gravity than the iron—up to top of bath as a scum, which is raked off prior to pouring the metal into the mould.

Having described the preliminary mould-forming preparations; *modus operandi* of making the teeth by machine; method of building up the internal structure of the mould with green sand arm cores, and dry sand covering in cores, besides giving some practical data on sands, metal mixtures,

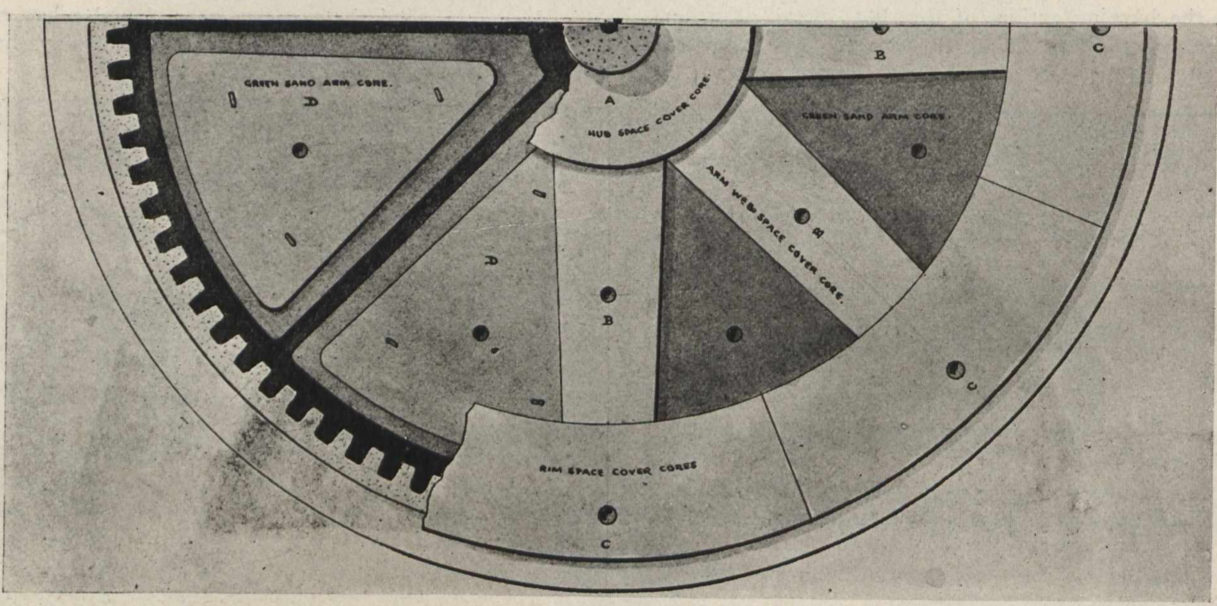



Fig. 6.

Half Plan.
Showing Green Sand Arm Cores.

Half Plan.
Showing Dry Sand Cover Cores.

The metal mixture from which I got the best results was used in casting a short-toothed rolling mill pinion, 40.20-inch pitch diameter, 18 teeth 6.98-inch pitch, 22-inch face, 16-inch bore, and weighing 4¼ tons. Here is what went into the cupola, and chemical analysis after it came out:—

| Metals. | % | Weight. lbs. | Chemical analysis Constituents. | % | [Tensile strength per sq. inch.] |
|---|---|---|---|---|---|
| * Meurkirk (4).. | 25% | 2,250 | Silicon . . . | 1.250 | |
| * Meurkirk (4¾) | 15% | 1,350 | Sulphur . . | 0.058 | |
| Maddison . . . . . | 25% | 2,250 | Phosphorus | 0.930 | |
| Gear scrap . . . . . | 25% | 2,250 | Manganese | 0.320 | |
| Isabella . . . . . . . . | 10% | 900 | Graphite . | 2.850 | |
| Wrought iron . . . | 10% | 900 | Com. carbon | 0.400 | |
| Total . . . . . . . . . . | | 9.900 lbs. | | | lbs. 38,197 |

** Prepared by W. A. Bole, general superintendent The Westinghouse Machine Company, for the foundry foremen at East Pittsburgh.

* These metals cost $26.00 per ton.

etc.; it only remains to add, that in estimating the amount of metal to be used in pouring the casting, at least a ton extra should be provided to flush through after it has once been filled; to ensure the elimination of occluded gases, or to eject any stray dirt which may have flowed in accidentally. To effect this purpose, capacious overflow gates should be provided, and a suitable pig bed made in the foundry floor in close proximity to the mould. It is not necessary to dwell upon the importance of feeding, both around the centre core and in the rim at junction of each arm; but as a final word we would emphasize the wisdom of determining carefully the time of hoisting out the centre core in order to accelerate the cooling of the heavy mass of metal in the hub, and thus adding uniformity of shrinkage. We had a costly experience by neglecting this precaution. A 15 ton gear was poured in the afternoon, and the removal of the core in the early hours of the next morning was left to a labor gang boss. He took out the 18-inch hub core before the metal skin was set, hence the hub began to bleed, leaving a huge cavity, and the gear had to be thrown on the scrap heap; at a loss of some $700, in addition to causing no end of profanity and financial loss down at the rolling mills where they were waiting for this large gear wheel.

# MITCHELL'S PATENT REVERSING GEAR.

### For Machines Driven in Two Directions.

When the British Westinghouse Electric and Manufacturing Company's plant at Manchester, England, commenced operations in 1902, the large planers were fitted with electric drives, and magnetic clutches for reversing. It was soon found, however, that whilst this method of reversing was simple, and in some respects effective, it was far from ideal, in fact, was a "constant source of annoyance and expense to keep running." But this trouble was soon overcome, for the Works Superintendent, W. C. Mitchell—one of the best practical mechanics that ever set foot in a machine shop,—invented a device which has reduced the maintenance of all the planers in the Trafford Park works, to a "negligible quantity." One of the chief advantages of this mechanical drive is, that a comparatively small constant speed motor can be used, since there is no starting or stopping as in the case of some recent electric drives.

The reversing mechanism is shown diagramatically in Fig. 1, where "A' represents the shaft carrying the pinion driving the machine. This pinion engages in an overhead gear turning a countershaft, on which is keyed pulley $P_4$, having belt, driving pulley $P_2$ in one direction; while pulley $P_3$ keyed on driving shaft "A," drives by belt, pulley $P_1$, in the opposite direction to $P_2$.

In addition, two jockey pulleys, $J_1$ and $J_2$ are brought into play in alternately tightening and loosening the belts running on $P_1$ and $P_2$ respectively. The jockey pulleys are actuated either mechanically or pneumatically, both processes giving equally satisfactory results. In the accompanying diagram "W" represents the pneumatic apparatus, which is controlled by the table stops and connected by levers to the supporting arms of the jockey pulleys. In the operation of the planer, the table dogs regulate an air valve which ad-

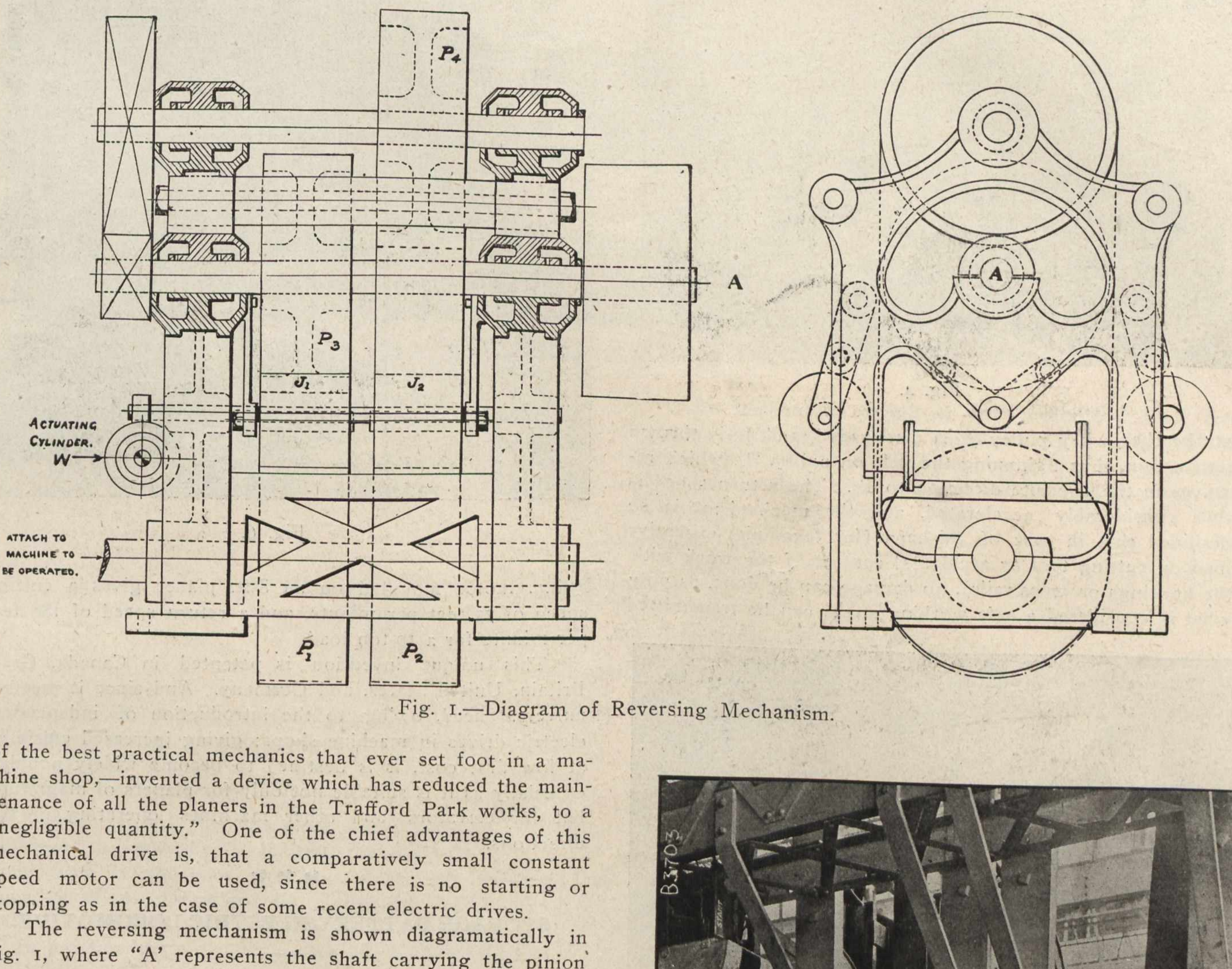



Fig. 1.—Diagram of Reversing Mechanism.

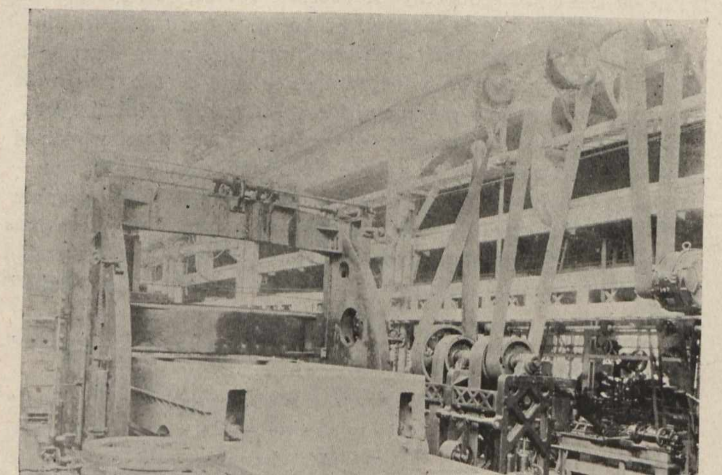


Fig. 2.

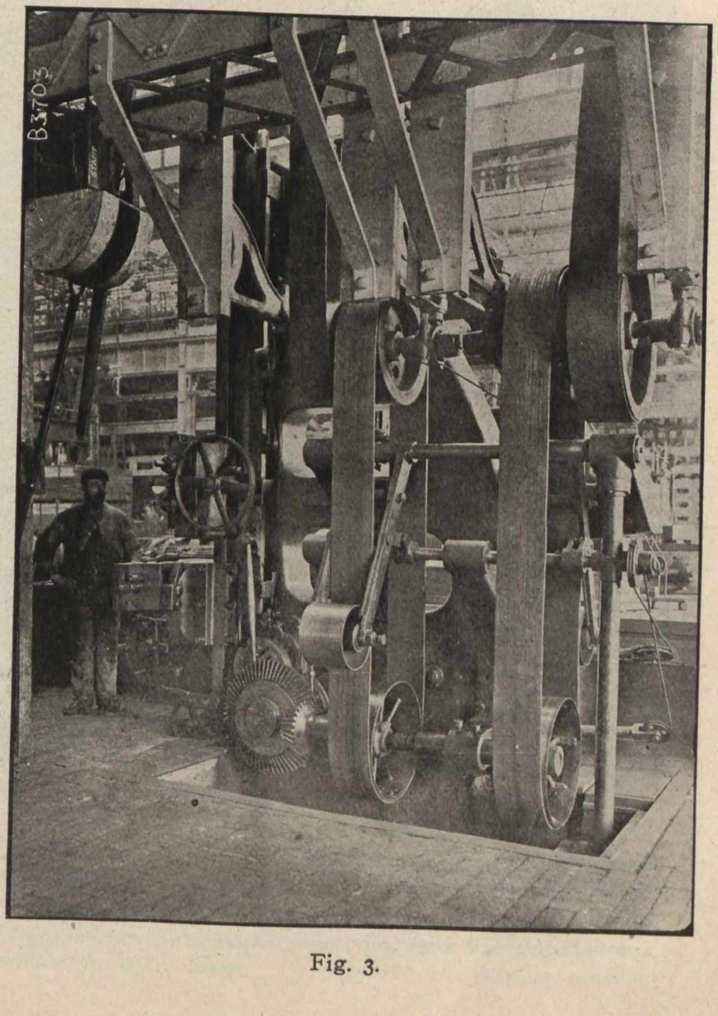



Fig. 3.

mits compressed air alternately to the opposite end of the cylinder, and by regulating the velocity of admission the speed of reverse can be nicely gauged. In the cutting motion the jockey pulley $J_2$ tightens the belt on the pulley $P_2$, driving the machine through the pinion in one direction. The belt on $P_1$ consequently runs loose, and has a clearance of about a quarter of an inch, the clearance gradually increasing with the speed of the table. At the end of

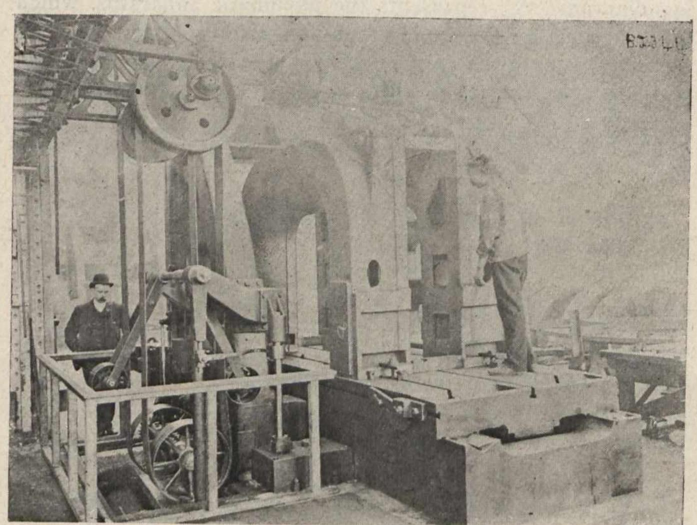


Fig. 4.

stroke the jockey pulley $J_2$ is disengaged, and $J_1$ is thrown into action, thus tightening the belt on pulley $P_1$, which revolves in the opposite direction to $P_2$. The return speed is thus considerably accelerated, and the mechanism is so designed that in case of mishaps (for example, excessive load on cutting tool or accidental contact of the work with the housings or cross rails), no damage can be done, as only what is considered a safe working stress can be transmitted

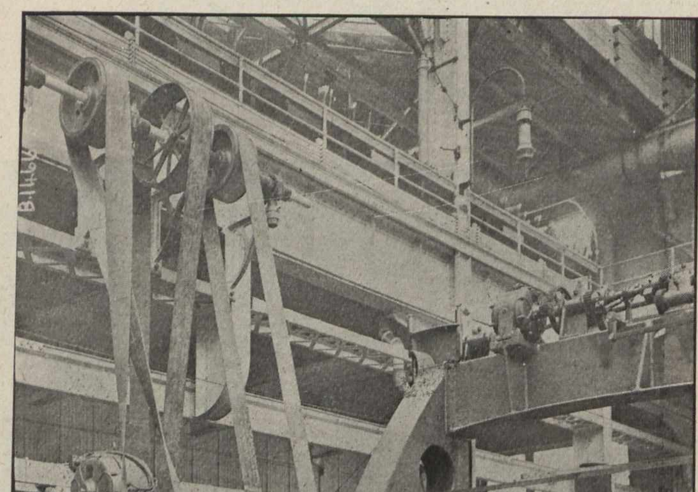


Fig. 5.

to any of the gears, thus eliminating any deleterious effects on the machine. Further, it disposes with a long succession of reducing and reversing gears, and provides a maximum amount of work with minimum expenditure of energy. A

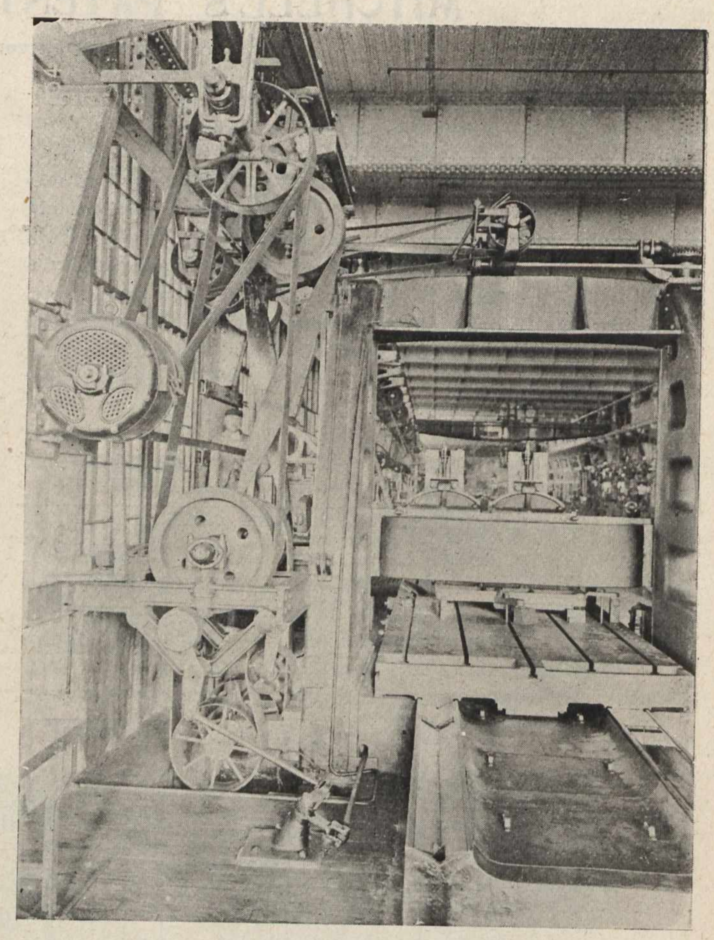


Fig. 6.

25-h.p. motor mounted on an 8-ft. planer gives a cutting speed of 75 feet per minute, and a return speed of 188 feet per minute for a 10-ton load.

This unique invention is patented in Canada, Great Britain, United States, and Germany. And since it meets a universal need, owing to the introduction of independent electric drives in machine shops; giving increased efficiency at low first cost, it is destined to become widely popular; especially as it is suitable not only for planers of magnitude, but for elevators and other machines operating in two directions.

❧ ❧ ❧

## STORAGE BATTERY ELECTRIC LOCOMOTIVE.

Through the courtesy of Messrs. Hurst, Nelson & Co., of Motherwell, near Glasgow, Scotland, we are able to illustrate the first important application of the storage battery in electric traction. This locomotive is one of the two built by the above-named company, for the Great Northern Piccadilly & Brompton Railway: one of the Yerkes underground electric railways now in course of installation in London.

Each locomotive is attached to eight bogie wagons, primarily designed for the purpose of removing excavating material, and taking in iron tunnel segments, sleepers, rails, and other material required in the construction of the "Tube" line.

The locomotive body over buffers is 50 feet 6 inches, and its width is 8 feet.

The main floor-frame covered with Jarrah wood, is built of steel channels 9 x 3½ x ½ with side sills 8 x 4 x ½ I beams, and intermediate sills 7⅞ x 3 x ⅜ channels, and the whole trussed by two side truss rods placed under each side sill, and I beams carried across at each truss post. Upon this substantial framework is erected a casing made up of ¼-in steel plates riveted to side sills at bottom, and to steel angle and flat at top, and where the storage battery is located are lined with Jarrah wood. The batteries were supplied by the Chloride Electrical Storage Company, and consist of eighty chloride cells each containing twenty-one plates and weighing in all about 36 tons. The normal discharge current is 179 amperes whilst the maximum energy load is 800 amperes. The batteries will be capable of storing sufficient energy to operate for a whole working day without recharging.

At each end of the locomotive there is a driver's cab fitted with a British Thomson-Houston master controller divisions, separated by a lattice girder frame passing longitudinally down the car from cab to cab, and its top supporting a series of sloping doors which cover and protect the secondary batteries. The height of locomotive from rail level to top of cabs is 9 ft. 6 in., the distance from rail level to top of battery tank being 6 ft. 8 in.


Storage Battery Electric Locomotive.

one of which (10 ft. 10 in. in length) is extended so as to accommodate the controlling apparatus, the air-compressor, and the air-receiver. The cabs are constructed entirely of steel, and are so arranged that they join the portion carrying the battery, the latter being on the Jarrah wood floor in two

The locomotives weigh 65 tons each, and their free running speed on the level, when hauling a load of about 60 tons, is from 7 to 10 miles per hour. They are each fitted with the automatic centre coupler buffers, and, also with the Westinghouse air-brake.

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# "ALLOYS."

BY PERCY LONGMUIR, OF LONDON, ENGLAND.

*Carnegie Research Medallist.*



(Continued.)

### Copper-Tin Alloys.

Notwithstanding the literature on these alloys, their application is exceedingly limited, the only general one being found in phosphor bronzes, which are essentially copper-tin alloys deoxidized by phosphorus, some portion of the latter element remaining in the final alloy.

In practice the only copper-tin alloys used are found in bell metals, in which the chief requirement is that of "tone," and strength is of secondary moment only. The Admiralty requirements for ships' bells are five of copper to one of tin, or—

| | |
|---|---|
| Copper | 83.3 % |
| Tin | 16.7 % |

This alloy gives a good tone, casts fairly well, and presents a good appearance when turned up. A trace of phosphorus is added just before casting, or sometimes the alloy is made up as follows:

| | |
|---|---|
| Copper | 82.0 % |
| Tin | 17.0 % |
| Yellow brass | 1.0 % |

where to some extent the zinc of the yellow brass acts as a deoxidizer. Gong metal approximates 80 copper and 20 tin, a composition which represents the highest content in tin of the bell metal series. Speculum metal is white in color, brittle in properties, and admits of a very high polish. Its application is, however, exceedingly limited, and for the greater part these alloys have been replaced by glass. A general composition is 67 of copper and 33 of tin. Ross's alloy contained 68.21 per cent. of copper and 31.79 per cent. of tin.

### Copper-Tin-Zinc Alloys.

Under this heading are grouped alloys known as machine brasses or gun metals. The origin of the term gun metal is familiar, but the copper alloys have long been superseded by steel for ordnance, and the only guns now made are small ornamental cannon. All modern gun metals contain zinc in amounts varying from 1½ per cent. up to appreciable quantities. The addition of zinc to a copper-tin alloy gives sharpness or "life" to the fluid alloys, and leads to the production of sounder castings. Three types of high quality gun metals are shown in the following table:

| | 1 | 2 | 3 |
|---|---|---|---|
| Copper | 88 | 86 | 87 |
| Tin | 10 | 10 | 8 |
| Zinc | 2 | 4 | 5 |

No. 1 is the Admiralty specification for gun metal castings. These alloys are used for high-pressure steam fittings, air and water pumps, engine and machine details, boiler mountings and the like. Typical tests of numbers 1, 2 and 3 obtained by the writer are as follows:

| | 1 | 2 | 3 |
|---|---|---|---|
| Maximum stress—tons per square inch | 18.0 | 17.0 | 16.5 |
| Elongation, per cent. on 2 inches | 11.0 | 10.5 | 9.0 |

Evidently, then, with care in casting, the three can be made to give very similar tension results, a remark also applicable to their behavior under steam or hydraulic tests. No. 3 is the least costly of the series, and is decidedly easier to treat in machine and finishing shops than the comparatively hard alloy, No. 1, a feature of some moment in estimating total costs. The highest and lowest tensile results obtained by the writer from some hundreds of experiments on Composition 1 are as follows:

| | Maximum Stress. Tons per square inch. | Elongation per cent. on two inches. |
|---|---|---|
| Highest | 20.0 | 16.0 |
| Lowest | 6.5 | 3.7 |

in every case composition being identical; i.e., copper, 88 per cent.; tin, 10 per cent., and zinc, 2 per cent. This wide range of variation emphasizes the care required in making up the alloys.

Typical compositions of ordinary commercial gun metals are included in the following table, Nos. 1 and 2 representing the usual run of alloys for valve bodies, engine and boiler fittings, but not for fittings in conjunction with high-pressure boilers or high-speed engines. Nos. 3 and 4 represent cheaper types of gun metal in which outside scrap enters largely into the composition:

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Copper, per cent. | 80 | 80 | 70 | 55 |
| Tin, per cent. | 4 | 6 | 4 | 5 |
| Zinc, per cent. | 10 | 8 | 4 | .. |
| Lead, per cent. | 6 | 6 | 4 | .. |
| Merchant scrap, per cent. | .. | .. | 18 | 40 |

As in the brasses, the addition of lead to a gun metal facilitates free turning. Scrap is, of course, a variable factor, and should as far as possible be sorted into uniform grades.

### Bearing Brasses.

Solid bearings are being largely replaced by shells lined with anti-friction metal. When a copper-tin alloy is used as a bearing brass its composition will vary between the following limits:

| | |
|---|---|
| Copper, from | 88 to 82 % |
| Tin, from | 10 to 14 % |
| Zinc, from | 2 to 4 % |

An intermediate alloy, copper, 84 per cent.; tin, 12 per cent., and zinc, 4 per cent., represents a composition which has successfully met severe service conditions. A cheap and hard bearing may be made from copper, 52 per cent.; tin, 8 per cent., and merchant scrap, 40 per cent. However, on the whole, bearing brasses of phosphor bronze yield better results than are obtained from copper-tin alloys.

It may be well to note here that the increase in hardness, followed by the increase in content of tin, is also associated with a sharp increase in brittleness. Only in the case of bearing brasses is it advisable to exceed a content of 10 per cent. tin, a feature illustrated in the following table, which represents the mean of six tests:

| Analysis. Copper. | Tin. | Zinc. | Maximum Stress. Tons per sq. inch. | Elongation per cent. on two inches. |
|---|---|---|---|---|
| 85 | 13 | 2 | 11.9 | 1.5 |

These results are of importance in view of the fact that gun metal is often stated as containing 16 per cent tin. Such a composition would be far too brittle for the purpose to which gun metal is usually applied; it is, in fact, a bell metal.

### Bronzes.

Manganese bronze has been dealt with under the heading of manganese brass. With this and phosphor bronze types of alloy the special constituent is chiefly noticeable by the low amount present. The latter is essentially a copper-tin alloy, containing from traces up to 1 per cent. phosphorus. Analyses of two typical varieties are given in the following table:

### Phosphor Bronze.

| | Ordinary or "Mild." | "Hard." |
|---|---|---|
| Copper | 89.31 | 88.63 |
| Tin | 10.16 | 10.32 |
| Arsenic | 0.01 | 0.01 |
| Antimony | 0.05 | 0.06 |
| Phosphorus | 0.47 | 0.98 |

The "hard" type is, in foundry practice, used for casting pinions, spur and bevel wheels, slide valves and bearing brasses. The "mild" type is extensively used for various machine and engine details, and also for heavy castings, such as the ram and stern fittings of a modern cruiser. Typical tensile tests of bars from commercial castings are shown in the following table, the bronze in each case being that of the "mild" type:

| | Maximum Stress. Tons per sq. inch. | Elongation per cent. on six inches. |
|---|---|---|
| 1 | 19.0 | 18.8 |
| 2 | 20.7 | 24.5 |
| 3 | 21.5 | 33.0 |
| 4 | 22.4 | 27.0 |
| 5 | 26.2 | 51.0 |

The usual specification for casting of this type is a maximum stress of 17 tons per square inch and an elongation of 15 per cent. on six inches. No. 5 represents the highest value the writer has obtained from this type of bronze. The lowest value from bronze of precisely the same composition is as follows:

| Maximum Stress. Tons per sq. inch. | Elongation per cent. on 6 inches. |
|---|---|
| 12.5 | 5.0 |

A comparison of the two elongations, viz., 5 per cent. and 51 per cent., is of much interest as showing the range of properties in an alloy of constant chemical composition.

As the amount of phosphorus increases beyond 0.5 per cent. ductility decreases, whilst hardness and brittleness increase. For a hard type of bronze that is a good bearing metal, 1 per cent. phosphorus is a suitable limit, but where extreme hardness is required 1½ or 2 per cent. may be added. A higher content of phosphorus than 2 per cent. is useless for castings. It will be noted that British phosphorus bronzes approximate 90 per cent. copper and 10 per cent. tin, whilst certain American types contain lead. Thus a typical "car brass" is as follows:

| | |
|---|---|
| Copper | 79.7 % |
| Tin | 10.0 % |
| Lead | 9.5 % |
| Phosphorus | 0.8 % |

### Aluminium Bronze.

The most general composition is. copper, 90 per cent., and aluminium, 10 per cent. For some reason these bronzes have not yet met with a very wide industrial application, probably owing to the fact that their properties have not been systematically investigated. From the foregoing composition the writer has obtained results varying between the following limits:

| Maximum Stress. Tons per sq. inch. | Elongation per cent. on 2 inches. |
|---|---|
| 18 to 26 | 2 to 16 |

It is hoped to shortly supplement these results by others obtained from a more exhaustive investigation.

### Copper-Nickel-Zinc Alloys.

Alloys containing these three metals are commercially known as "German silver." Essentially, they are copper-zinc alloys, whitened by the addition of nickel. The range in composition is shown in the following table:

| No. | Copper %. | Nickel %. | Zinc %. |
|---|---|---|---|
| 1 | 63 | 5 | 32 |
| 2 | 66 | 8 | 26 |
| 3 | 62 | 10 | 28 |
| 4 | 50 | 18 | 32 |
| 5 | 62 | 15 | 23 |
| 6 | 65 | 15 | 20 |
| 7 | 67 | 19 | 14 |
| 8 | 60 | 20 | 20 |

Any one of the foregoing compositions will with careful handling yield sound castings. No. 8 is, however, recommended as the best all-round alloy for color and lustre. The higher the content of nickel the better the appearance, as also the greater the cost of the alloy. German silver cast into ingot or strip moulds for subsequent rolling into wire or rod should be free from lead; but this metal may be present in castings made in sand moulds, its addition being to facilitate turning of or filing. Iron is also occasionally found in German silver castings, this metal tending to increase hardness; in the majority of cases, however, its presence is accidental. Types containing lead or iron are shown below:

| No. | Copper. | Zinc. | Nickel. | Lead. | Iron. |
|---|---|---|---|---|---|
| 1 | 48 | 32 | 15 | 5 | .. |
| 2 | 57 | 30 | 10 | 3 | .. |
| 3 | 60 | 28 | 10 | .. | 2 |
| 4 | 56 | 32 | 11 | .. | 1 |

### White Metals.

Anti-friction alloys are extensively used for lining the bearing surfaces of brass, steel or iron bushes. Before lining, the inner surfaces of the bushes are cleaned by sand blast or by pickling in weak acid and then tinned in order to ensure a better contact of the lining metal. The thickness of the lining varies from ¼ to ½ inch, and lining is effected by running the white metal into the space left by the insertion of a core of sheet iron into the bush. The diameter of this core or mandril is less than that of the finished bearing in order to allow material for machining up to size. The white metal is maintained in a molten condition and ladled out as required.

Three types of high quality white metal are found in the following table:

| No. | Copper %. | Tin %. | Antimony %. |
|---|---|---|---|
| 1 | 5.5 | 86.0 | 8.5 |
| 2 | 7.0 | 85.0 | 8.0 |
| 3 | 8.5 | 83.0 | 8.5 |

These compositions vary only slightly, and are typical of high quality babbit metals. The following compositions represent the less costly types of white metal, the content of tin being the governing factor as regards cost:

| No. | Copper % | Tin % | Antimony % | Lead % | Zinc % |
|---|---|---|---|---|---|
| 1 | 9 | 73 | 18 | .. | .. |
| 2 | 3 | 53 | 10 | 33 | 1 |
| 3 | .. | 40 | 6 | 54 | .. |
| 4 | .. | 20 | 12 | .. | 68 |
| 5 | 5 | .. | 10 | .. | 85 |
| 6 | 4 | 19 | 3 | 5 | 69 |
| 7 | .. | .. | 16 | 84 | .. |

An alloy used in the form of cast rings for piston-rod packing is as follows:

| Tin. | Lead. | Antimony. | Arsenic. |
|---|---|---|---|
| 21 | 69 | 9.5 | 0.5% |

An anti-friction alloy, used as packing, is composed of:

| Tin. | Lead. | Antimony. |
|---|---|---|
| 43 | 56 | 1 |

The alloy is cast into blocks, and afterwards machined into thin shavings. The shavings, mixed with vaseline and graphite, are used for packing purposes.

### Solders.

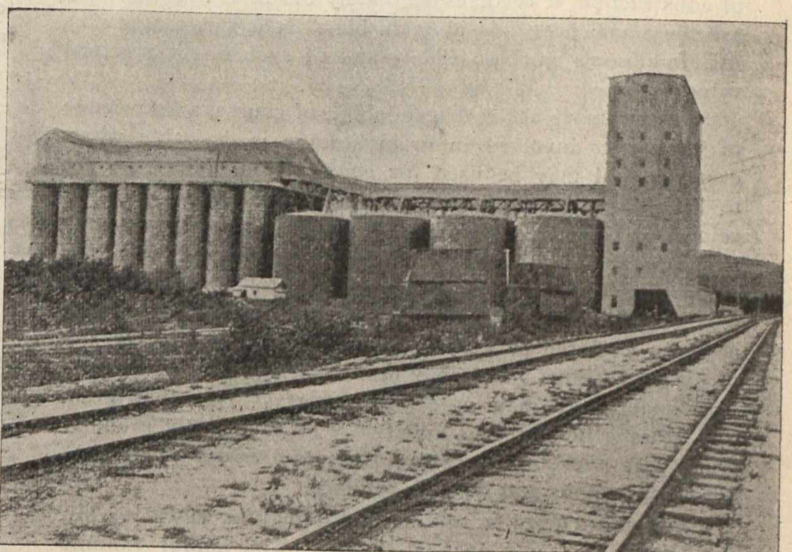
Hard solders have already been dealt with. Three typical soft solders are given below:

| | Lead. | Tin. |
|---|---|---|
| Fine solder | 34 | 66 |
| Tin solder | 50 | 50 |
| Plumbers' solder | 66 | 34 |

A series of fusible alloys used in the production of safety plugs are given in the following table:

| No. | Bismuth. | Lead. | Tin. | Cadmium. |
|---|---|---|---|---|
| 1 | 50.0 | 31.3 | 18.7 | .. |
| 2 | 50.0 | 27.0 | 23.0 | .. |
| 3 | 50.0 | 25.0 | 25.0 | .. |
| 4 | 50.0 | 24.0 | 14.0 | 12.0 |

* * *



Canadian Pacific Railway Co.'s Elevator "D" at Fort William, Ontario. The Largest Single Elevator in Canada, With a Capacity of 3,300,000 Bushels.

## Grain Pressure in Deep Bins

BY J. A. JAMIESON, C.E., OF MONTREAL.

(From Engineering News, New York.)

[In view of the deplorable collapse of the cylindrical storage tanks of the C.P.R. Elevator "D," Fort William, which reduces the grain storage capacity at that point by nearly 3,000,000 bushels at a time when handling and storage capacity is so badly needed to take care of the immense crop of the North-West, and the very serious loss owing to the probability that the whole storage plant will require to be torn down and rebuilt, since the design is manifestly wrong fundamentally, we have deemed it opportune to reproduce the very admirable editorial from the columns of our contemporary, "Engineering News," commenting on the valuable paper on "Grain Pressures in Deep Bins," read by J. A. Jamieson, C.E., before the Can. Soc. C. E. We also find on record in the 1903 transactions of the society that Mr. Jamieson during the discussion of his paper several months previous to the collapse, and before it had been loaded, referring to calculations which he had made as to the strength and design of the above structure, stated that he considered its failure inevitable.

The disastrous failure of the storage structure of Elevator "D" and the recent breakdown of the machinery in the new Elevator "B," Fort William, coupled with the rumors of impending trouble with the bin structure of the Montreal Harbor Commissioners' elevator, and its exceedingly unsatisfactory handling performance, and since other elevators may be under construction, the design of which may not be based on a sufficient knowleuge of grain pressures, constrains us to draw attention to Mr. Jamieson's historic paper.—Editor.]

The safe and proper design of grain storage elevators is a matter of much importance to a country which exports and deals in grain on such a scale as America. Yet, strange to say, there have hitherto existed, practically no accurate data for the structural design of elevator bins. The series of careful tests on grain pressures made by Mr. J. A. Jamieson, of Montreal, and recorded on another page of this issue puts at the disposal of engineers for the first time, clear and comprehensive experiments in this field.

In particular, the series includes the first reliable measurements of grain pressure in full-size (actual) bins that have ever been published. Doubtless there exists other tests or individual observations of grain pressures in deep bins which have been made at one time or another, and we trust that they may be brought forward at the present time in order to place on record as much definite knowledge as possible.

It has been known that in deep bins which in this country are universally used for grain storage, there is a head or depth of grain which, were the grain a liquid, would produce enormous bursting pressures. The actual pressures in elevator bins have never been determined from accurate experiment; but it has been well recognized that, while the traditional design of wooden bins would not withstand the pressure of an equivalent liquid in place of grain, yet it had by years of practical use been proved adequate for grain storage. Now that the desire to build grain elevators fire-proof is leading to the use of new materials and methods of construction, it becomes absolutely essential to learn what are the actual pressures in grain bins. It is this that makes Mr. Jamieson's work so timely and of such direct practical value.

From a more abstract standpoint, of course, a knowledge of the forces involved in grain storage is desirable whatever material may be used for construction, unless we are to be content to work forever by the rules of thumb developed in the past. Moreover, the subject of grain pressures has a wider interest for the light it sheds upon the forces in granular and semi-liquid masses generally. In this way it is related to the subject of retaining walls, a field only partially explored as yet. Without attempting to give any of the conclusions which may be drawn from Mr. Jamieson's experiments, we may note the important fact that grain in a storage bin, behaves apparently as a perfectly granular mass, with constant internal and external friction, i.e., without compressions and without cohesion.

This is involved in one item that may be added to Mr. Jamieson's unusually complete paper. The author exhibits in detail a method of calculating grain pressure as developed from his tests. The method is capable of being summarized in a simple formula, and the pressure curves obtained from this formula, agree remarkably with the test curves exhibited in the paper. The formula is derived from a consideration of the weight carried by any element of the bin-walls, due to the friction of the grain pressing against it. A fundamental assumption, is that for a given kind of grain there exists a constant ratio between the lateral (or horizontal) and vertical unit-pressure at all points in the mass. The assumption is well verified by the test pressures observed by Mr. Jamieson.

If we write:

V = vertical pressure of grain per square foot at depth below the surface of the grain.

W = weight of grain in lbs. per cubic foot.

F = Coefficient of friction of grain against side wall.

K = ratio of lateral to vertical unit-pressure.

R = ratio of area to perimeter of horizontal cross-section of the bin, and

E = the base of the Naperian system of logarithms, we get the formula,

$$V = \frac{R\,w}{f\,k}\left(1 - e^{\frac{-f\,k}{R}h}\right)$$

It should be said that this same formula was derived in 1895 by Mr. H. A. Janssen, of Hamburg, Germany, whose work on this subpect is noted by Mr. Jamieson.

The formula given may be simplified by reference to some practical conditions. Wheat weighs 50 lbs. per cubic foot, and Mr. Jamieson finds that the factor k for wheat is very closely 0.6, while the friction coefficient f for ordinary bin-walls averages about 0.4. We may, therefore, take the product k f to be 0.25. Further, for all square or round bins the ratio R is constant and equal to one-fourth the diameter.

Using these values in the above formula gives,

$$V = 50\,d\left(1 - e^{\frac{-h}{d}}\right)$$

The term in parenthesis approaches the value unity as the depth of the grain increases. The limiting value of the vertical pressure, is, therefore:

Vertical pressure in lbs. per sq. ft. = 50 times diameter of bin in feet.

It may be noted further that the term in parenthesis reaches the value 0.9 when the depth of grain equals 2.3 times the diameter of the bin. For all ordinary cases, therefore we may use the limiting maximum pressure directly. The horizontal pressure, of course, is at all times 0.6 as great as the vertical pressure. As is shown by Mr. Jamieson these pressures must be slightly increased if other materials than wheat are to be stored in the bin, the largest increase, 20 per cent., being for peas.

## A NEW PLUMB-BOB.

J. S. J. Lallie, of Denver, Colorado, is the inventor of many useful instruments and attachments which are in daily use among civil, hydraulic, and mining engineers.

Mr. Lallie's latest invention is an automatic plumb-bob, and the principal features of interest which his new bob possesses, that appeals to every engineer, is the instantaneous action in elevating or depressing the bob to any desired position, without the use of screws or other tedious devices.

The engineer can make an adjustment of the bob just as readily while wearing gloves as without them and, when the survey is complete, the cord may be instantly coiled within the bob.

Excellent proportion has been taken into consideration in shaping this new plumb-bob, and it is provided with a case-hardened steel point; steel bushing in the head which is carefully rounded to preserve the cord.

## BOYS WANTED.

Boys of spirit, boys of will,
Boys of muscle, brain and power,
Fit to cope with anything.
These are wanted everyhour.

Not the weak and whining drones,
Who all troubles magnify,
Not the watchword of "I can't."
But the nobler one, "I'll try."

Do whate'er you have to do
With a true and earnest zeal;
Bend your sinews to the task,
"Put your shoulders to the wheel."

Though your duty may be hard,
Look not on it as an ill;
If it be an honest task,
Do it with an honest will.

In the workshop, on the farm,
At the desk, where'er you be,
From your future efforts, boys,
Comes a nation's destiny.—Selected.

## THE PEARL SQUARE AUGER AND MORTISING TOOL.

Through the courtesy of Col. Jas. R. Branch, President of the Pearl Square Auger Manufacturing Company, of New York, we are enabled to illustrate and describe one of the most novel and ingenious wood-working tools ever invented. We have personally handled this tool, hence can bear witness that it is not a mere toy, but a genuine labor saving device. As shown in Fig. 1, it is a combination of an ordinary circular auger bit, and two side cutters, all arranged on the same spindle. The auger bores a round hole, while the cutters form a square. The round bit at end of the tool is detachable, and can, if necessary, be screwed off the spindle. The square head which is formed on the end of the shell that encases the spindle is cut away on two opposite sides, at the extreme end, and in the recesses so made, two cutters are placed, which revolve in planes, parallel to each other, and their outer surfaces project very slightly above the surfaces of the square end of the shell. These side revolving cutters gear with a small star-wheel on the spindle, and revolve rather slower than the round bit. As the side cutters leave between them a small portion of the wood which the round bit, owing to its circular form has not removed, two small disc cutters—one on each side of the square head between the side cutters,—remove this as the tool passes into the hole. These small discs are held in place by screws, one of which may be seen on the front face of the head in Fig. 1. The tail-end of the shell-piece forms a ball-bearing, which supports the spindle and takes the thrust. The bearing is held in place by a screw as shown in illustration. Between the ball-bearing and the head the spindle has on it a helical band which removes the wood as it is cut away and throws it out through the opening in the side of the shell.

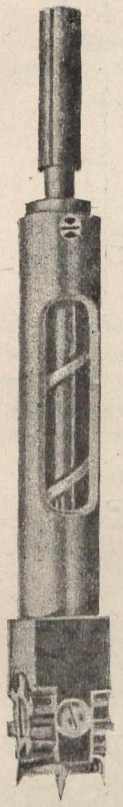


Fig. 1. Pearl Square Auger.

When the tool is used for mortising, it is essential that the wood is held firmly in place and that the bit runs truly and does not vibrate in the chuck or spindle of the machine that drives it. There are several methods by which the shell may be prevented from revolving while in use, one of them being the employment of a split bushing which fits tightly over the shell, and is fixed by a clamp-nut. The bushing may have a light projecting arm which bears against some part of the machine which drives the bit. Special appliances are made for use when the square auger is employed for mortising. All parts of this tool are accurately made, and carefully hardened, so as to ensure durability.

The following extract from the "Report of the Nineteenth Triennial Exhibition of the Massachusetts Charitable Mechanics Association," will serve to indicate the practical advantages of this unique invention:—

During this exhibition the augur was worked in knotty maple, oak and spruce, also ash, chestnut, hard pine and whitewood. For certain kinds of work this machine is a great labor saver. It is said to work admirably in making the mortises for car building. The members of the Board of Judges were all practical mechanics, with large experience in wood-working machines, and their opinion is expressed by their award of a GOLD MEDAL.

In a lumber-growing, and wood-working country like Canada, this special tool ought to have widespread popularity.

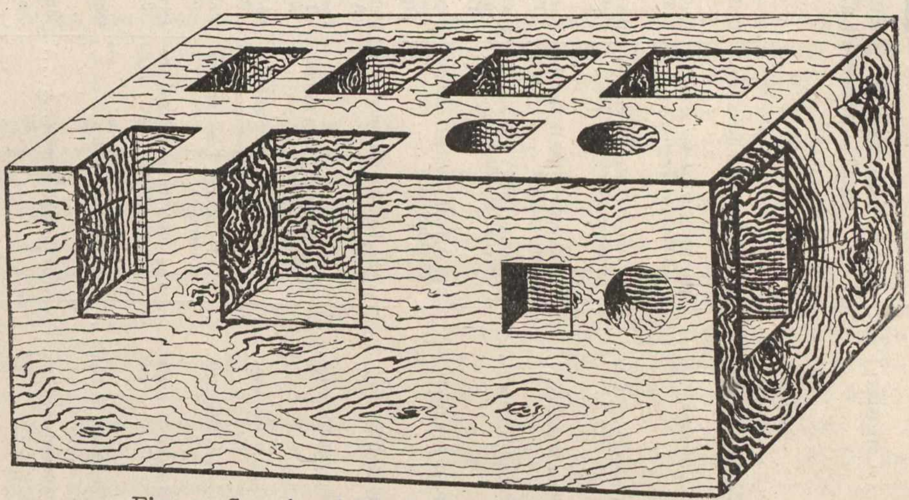


Fig. 2.—Sample of Work Done With a Square Auger.

## THE SUCCESSFUL MAN.

Who's the man who wins success?
The man who early rises,
The man who springs surprises,
The man who Advertises;
He's the man who wins success.

## A NEW FLY WHEEL FORMULA.

R. E. Mathot, the Belgian gas engine expert, gives the following formula for fly wheel dimensions of the various types of large engines, having regard to the use to which the engine is to be put:

$$P = K \frac{N}{D^2 an^3}$$

P = the weight of the rim, without arms or bosses, in tons.

D = the diameter of centre of gravity of the rim in meters.

a = the degree of irregularity.

n = r.p.m.

N = the number of B.H.P.

K = coefficient varying with the type.

The total weight of the flywheel is 1.4 x P.

K is given in the following values:

44,000 for four cycle engines, single cylinder, single acting.

28,000 for four cycle engines, two opposite cylinders, single acting, or one cylinder double acting.

25,000 for two cylinders, single acting, with cranks set at 90 degrees.

21,000 for two twin cylinders, single acting.

7,000 for four twin opposite or four two tandem. cylinders, double acting.—Gas Engine.

### Tune: "British Grenadiers."

Some talk of millimetres and some of kilogrammes,
And some of decilitres to measure beer and drams;
But I'm a British workman, too old to go to school;
So by pounds I'll eat, and by quarts I'll drink, and
I'll work by my three-foot rule.

# EXTRACTS FROM AN ENGINEER'S NOTE BOOK

## GEAR WHEEL FORMULÆ

### MACHINE CUT TEETH—BROWN AND SHARPE STANDARD

## DIAMETRAL PITCH

Diametral Pitch is the number of Teeth to each inch of the Pitch Diameter.

| To Get | Having | Rule | Formula |
|---|---|---|---|
| The Diametral Pitch | The Circular Pitch | Divide 3.1416 by the Circular Pitch | $P = \frac{3.1416}{P'}$ |
| The Diametral Pitch | The Pitch Diameter and the number of Teeth | Divide Number of Teeth by Pitch Diameter | $P = \frac{N}{D'}$ |
| The Diametral Pitch | The Outside Diameter and the Number of Teeth | Divide Number of Teeth plus 2 by Outside Diameter | $P = \frac{N+2}{D}$ |
| Pitch Diameter | The Number of Teeth and the Diametral Pitch | Divide Number of Teeth by the Diametral Pitch | $D' = \frac{N}{P}$ |
| Pitch Diameter | The Number of Teeth and Outside Diameter | Divide the product of Outside Diameter and Number of Teeth by number of Teeth plus 2 | $D' = \frac{DN}{N+2}$ |
| Pitch Diameter | The Outside Diameter and the Diameter Pitch | Subtract from the Outside Diameter the quotient of 2 divided by the Diametral Pitch | $D' = D - \frac{2}{P}$ |
| Pitch Diameter | Addendum and the Number of Teeth | Multiply Addendum by the Number of Teeth | $D' = s\,N$ |
| Outside Diameter | The Number of Teeth and the Diametral Pitch | Divide Number of Teeth plus 2 by the Diametral Pitch | $D = \frac{N+2}{P}$ |
| Outside Diameter | The Pitch Diameter and the Diametral Pitch | Add to the Pitch Diameter the quotient of 2 divided by the Diametral Pitch | $D = D' + \frac{2}{P}$ |
| Outside Diameter | The Pitch Diameter and the Number of Teeth | Divide the Number of Teeth plus 2 by the quotient of Number of Teeth and by the Pitch Diameter | $D = \frac{N+2}{\frac{N}{D'}}$ |
| Outside Diameter | The Number of Teeth and Addendum | Multiply the Number of Teeth plus 2 by Addendum | $D = N+2)\,s$ |
| Number of Teeth | The Pitch Diameter and the Diametral Pitch | Multiply Pitch Diameter by the Diametral Pitch | $N = D'P$ |
| Number of Teeth | The Outside Diameter and the Diametral Pitch | Multiply Outside Diameter by the Diametral Pitch and subtract 2 | $N = DP - 2$ |
| Thickness of Tooth | The Diametral Pitch | Divide 1.5708 by the Diametral Pitch | $t = \frac{1.5708}{P}$ |
| Addendum | The Diametral Pitch | Divide 1 by the Diametral Pitch or $s = \frac{D'}{N}$ | $s = \frac{1}{P}$ |
| Root | The Diametral Pitch | Divide 1.157 by the Diametral Pitch | $s + f = \frac{1.157}{P}$ |
| Working Depth | The Diametral Pitch | Divide 2 by the Diametral Pitch | $D'' = \frac{2}{P}$ |
| Whole Depth | The Diametral Pitch | Divide 2.157 by the Diametral Pitch | $D'' + f = \frac{2.157}{P}$ |
| Clearance | The Diametral Pitch | Divide .157 by the Diametral Pitch | $f = \frac{.157}{P}$ |
| Clearance | Thickness of Tooth | Divide Thickness of Tooth at Pitch Line by 10 | $f = \frac{t}{10}$ |

## CIRCULAR PITCH

Circular Pitch is the distance from the centre of one tooth to the centre of the next tooth, measured along the pitch circle.

| To Get | Having | Rule. | Formula. |
|---|---|---|---|
| The Circular Pitch | The Diametrical Pitch | Divide 3.1416 by the Diametral Pitch | $P' = \frac{3.1416}{P}$ |
| The Circular Pitch | The Pitch Diameter and the Number of Teeth | Divide Pitch Diameter by the product of .3183 and Number of Teeth | $P' = \frac{D'}{.3183\,N}$ |
| The Circular Pitch | The Outside Diameter and the Number of Teeth | Divide Outside Diameter by the product of .3183 and Number of Teeth plus 2 | $P' = \frac{D}{3188\,N+2}$ |
| Pitch Diameter | The Number of Teeth and the Circular Pitch | The continued product of the Number of Teeth, the Circular Pitch and .3183 | $D' = NP'.3183$ |
| Pitch Diameter | The Number of Teeth and the Outside Diameter | Divide the product of Number of Teeth and Outside Diameter by Number of Teeth plus 2 | $D' = \frac{ND}{N+2}$ |
| Pitch Diameter | The Outside Diameter and the Circular Pitch | Subtract from the Outside Diameter the product of the Circular Pitch and .6366 | $D' = D - (P'.6366)$ |
| Pitch Diameter | Addendum and the Number of Teeth | Multiply the Number of Teeth by the Addendum | $D' = N\,s$ |
| Outside Diameter | The Number of Teeth and the Circular Pitch | The continued product of the Number of Teeth plus 2, the Circular Pitch and .3183 | $D = (N+2)P'.3183$ |
| Outside Diameter | The Pitch Diameter and the Circular Pitch | Add to the Pitch Diameter the product of the Circular Pitch and .6366 | $D = D + (P'.6366)$ |
| Outside Diameter | The Number of Teeth and the Addendum | Multiply Addendum by Number of Teeth plus 2 | $D = s(N+2)$ |
| Number of Teeth | The Pitch Diameter and the Circular Pitch | Divide the product of Pitch Diameter and 3.1416 by the Circular Pitch | $N = \frac{D'3.1416}{P}$ |
| Thickness of Tooth | The Circular Pitch | One-half the Circular Pitch | $t = \frac{P'}{2}$ |
| Addendum | The Circular Pitch | Multiply the Circular Pitch by .3183, or $s = \frac{D'}{N}$ | $s = P'.3183$ |
| Root | The Circular Pitch | Multiply the Circular Pitch by .3683 | $s + f = P'.3683$ |
| Working Depth | The Circular Pitch | Multiply the Circular Pitch by .6366 | $D'' = P'\ 6366$ |
| Whole Depth | The Circular Pitch | Multiply the Circular Pitch by .6866 | $D'' = P'.6866$ |
| Clearance | The Circular Pitch | Multiply the Circular Pitch by .05 | $f = P\ .05$ |
| Clearance | Thickness of Tooth | One-tenth the Thickness of Tooth at Pitch Line | $f = \frac{t}{10}$ |

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# The Canadian Engineer.

ESTABLISHED 1893.

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THE CANADIAN MACHINE SHOP

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## The Coming Revolution

II.

In our last issue, we pointed out mighty changes in metallurgical processes looming in the distance. But a mightier revolution is now taking place in the domain of Mechanical Engineering, and this revolution is none the less powerful and irresistible, because almost silent and imperceptible. The most powerful forces in nature are noiseless and unseen. The advent of the electric furnace will touch the future of thousands of Engineers, whose careers have become crystalized along the old lines of the blast furnace, steel converter, open-hearth furnace and crucible; but the passing of the steam locomotive, and stationary reciprocating steam engine, will interfere with the career of tens of thousands. History—as far as the conduct of life is concerned—is valueless, unless its lessons of the past are read as guide posts, enabling us to step surefootedly where our fathers walked with fear and trembling. The introduction of nail making machinery some thirty or forty years ago, threw out of employment thousands of hand nail makers in the "Black Country" of England. The open-hearth steel furnace, producing low carbon steels, has to a large extent, displaced wrought iron, hence has thrown out of work an immense multitude of puddlers. The invention of blue-printing has reduced the staff of tracers in workshop drafting rooms, by at least one-half. We cited in our previous article, the startling exit of the cable railway industry thirteen years ago; and the havoc it wrought. Only the other day in Montreal, a leading business man, whose company has just erected a new plant, said to us that it was pitiful to see the leather belt men coming around; inasmuch as their chances of doing business were hopeless since his firm had decided to introduce electric instead of belt drives into their new factory. Ten years ago, there seemed a golden opportunity for gear moulding by machinery, but gears with cut teeth came into fashion, and machine moulding is now confined to making hub, arms, and solid rim for emergency gears required in mill and factory breakdowns. Well do we remember hearing thirteen years ago a well-known mechanical engineer plead with the president of a large firm to take up the manufacture of electrical appliances. The reply was, that the band should play over his body first. That company is out of existence; their plant was swallowed up by one of the largest Electrical concerns in the world to-day. It is the old, old story, "cut it down, why cumbereth it the ground." Trades unions have sometimes tried to stop this onward march of invention and progress. Sometime ago, it was proposed to introduce pulley and gear moulding machines into a well-known Ontario foundry, but the project was not countenanced, owing to the known opposition of the moulders to the introduction of machinery, and fear lest the men would strike. The ancient cry of "Great is Diana of the Ephesians" may have done 1,800 years ago, when our British ancestors were tatooing their bodies and trying to resist the legions of Julius Caesar; but surely in these days of enlightenment, and at a time when the eyes of the civilized world are upon Canada in expectation of great things—especially in iron and steel development, an obstructive, selfish, retrograde policy like the one last mentioned, would be nothing less than criminal. It would be simply imitating the ostrich, which stops and hides its head in the sand, upon finding itself overtaken by the hunter. It may be hard for Manufacturers, Engineers, and Mechanics to abandon in the twentieth the methods they learned in the nineteenth century; but if they want to keep in the procession, they will use the wisdom which only experience brings, in at once preparing to face the revolutionary changes which are already upon us; and to adapt themselves to the altogether new condition of things in metallurgy and engineering. Any attempt to stay the onward march of invention and progress will be as futile as was Mrs. Partington's celebrated attempt to stop the flow of the Atlantic Ocean by a vigorous use of her mop.

Having pointed out some rocks ahead, we intend in our December number, dealing with special workshop appliances and prime movers, which are steadily but surely displacing the old types which came into being when George III. was King.

## Editorial Notes

**Industrial Patriotism.** In our portrait gallery of men who have "done things" in the interests of Canadian industry, we had occasion in July to cite Mr. Frederick Nicholls as our first example. A correspondent thought we had overdrawn the picture. But subsequent events are confirming all we said. On October 18th, the Dominion Iron & Steel Company held its annual meeting at Montreal, and the report of the past year's work was very cheering. Among the incidents which transpired, was the resignation of Mr. Frederick Nicholls as one of the Vice-Presidents. Here is what the President, Mr. J. H. Plummer said about it:—

> I regret exceedingly the retirement of Mr. Nicholls as Vice-President, for he has served the Company well and faithfully. Personally, I could not have got along very well without his services at a time when the business of the Company was at a low ebb. Mr. Nicholls has refused to accept any remuneration for his services, as he gave them in order to pull through a great Canadian industry, and I think he has saved us from going into liquidation.

Mr. Nicholls, replying to a special vote of thanks for his services, said, that he would have considered it detrimental to Canada, apart from the standpoint of the stockholders, had they allowed such a work as the Dominion Iron & Steel Company is doing, to fail through lack of energy to push it forward.

"The Canadian Engineer,"—as an outlook committee in the interests of the iron and steel industries of the Dominion,—is proud to note this commendable example of industrial patriotism. In face of the terrible revelations of corruption in high places across the border, this unselfish, public-spirited service of Mr. Nicholls is an honor and credit to Canada.

**Get Ready To Fill The Bill.** "Colliers,"—the most popular weekly in the United States—has not always given Canada a "square deal," but the logic of events, has evoked this wise deliverance:—

> The greatest wheat crop in the world has just been harvested in the new Provinces of Alberta and Saskatchewan. Where wheat grows so abundantly people must go and cities must arise. Because of the great material heritage of these people, the development of this new nation will be much faster than it was in the West of the United States.. The youth of wisdom and ambition who dreams of great things should not overlook these significant facts. To-day the index finger of opportunity points north.

We have it on high authority, that "there is a tide in the affairs of all men, which taken at the flood, leads on to fortune." Our American cousins being witness, the flood tide is coming, and coming rapidly. Therefore, to the younger generation of Canadian engineers, we say, do not let excessive sport and the pursuit of pleasure hinder your chances of success when your opportunity comes. The Canadian Bank of Commerce has recently been advertising in Glasgow, Scotland, for junior clerks, because of their alleged inability to find suitable material here. A serious burden rests upon our Technical Institutions and Engineering Establishments, to see to it, that the training of our embryo Engineers is *up to date*, and that their creative, inventive and co-ordinating powers are so developed, that when the demand crisis comes, we may have the right kind of men to fill the bill.

**The Latest Inventions.** We purpose—beginning with our December number—setting apart a special section of our Journal to the chronicling of the latest inventions having special practical merit, as they issue from the Patent Offices of Canada, Great Britain, and the United States. These new ideas will be graphically illustrated, and clearly described.

* * *

**Our Book Reviews.** A reference to page 351, will show that we are making a feature of the reviewing of new Technical Books which we conceive have exceptional merits from an educational standpoint. It is an encouraging sign of the times, that in these days of specialization, experts are giving out their best. While these productions may not be purely philanthropic, and may be examples of that "last infirmity of noble minds," it is an inestimable boon to our younger Engineers; for many a time it is giving away data of priceless value, the outcome of sleepless nights, and hard-earned experience which money can not buy. It enables a man to walk into the strange regions of Engineering with known bounds and landmarks.

* * *

## CANADIAN ASSOCIATION STATIONARY ENGINEERS.

### Toronto, No. I.

### ANNUAL BANQUET.

The nineteenth annual banquet in connection with the above organization was held at the Walker House, on Thanksgiving Eve, October 25th, and was one of the most successful, as regards numbers, quality of menu and high level of oratory, ever held in the history of this popular industrial fraternity.

Shortly after 9 o'clock, some 160 stationary engineers—whose motto is, "economy, intelligence, reliability and safety,"—and their guests, among whom were Alderman J. H. McGhie, Ald. S. A. Jones, Dr. Pakenham, Principal of Toronto Technical School; A. W. Sweet, Executive President C.A.S.E.; S. Groves, Editor "The Canadian Engineer;" T. Young, of "Electrical News," etc., sat down in the banquetting hall, to an excellent repast, followed by a "feast of reason and flow of soul." President William McGhie, of Toronto, No. 1, was toastmaster, and right genially did he play his part on this festive occasion.

**Toast List.**

"The King," by President Wm. McGhie; "Canada, Our Home," by Ald. J. H. McGhie; to "Our Legislature," by Ald. S. Alfred Jones; to "Educational Interests," by Dr. Pakenham, and Trustee Harry Simpson; to "Manufacturing Interests," by Mr. J. J. Main; to "The Executive Council," by Messrs. A. W. Sweet, of Hamilton, Charles Moseley and A. M. Wickens; to "Sister Societies," by Messrs. J. Fox and J. Ironsides, and to "The Press,"—S. Groves, M.E., of "The Canadian Engineer," was down to respond to this toast, but in his absence Technical Journalism was ably taken care of by T. Young, of "The Electrical News."

The proceedings were pleasantly enlivened by songs, ventriloquial displays, etc.

The success of this event was largely due to H. E. Terry, Chairman of Committee; W. Tait, Secretary-Treasurer, and a capable committee composed of Chas. Moseley, John W. Marr, Alex. Storer, Wm. Corrigan, Wm. Outhwaite, Chas. Birrell, Jos. Hughes, and Geo. Mooring.

May this commendable educational society have many happy returns of the day and continue to prosper is the cordial greeting of "The Canadian Engineer."

## Book Reviews

**The Hon. Peter White: A Biographical Sketch of the Lake Superior Lake Country.** By Ralph D. Williams, editor "Marine Review." Cleveland, Ohio: The Penton Publishing Co. 9¼" x 7¼". 205 pp. (Price $1.50 net, postage 15 cents.).

Here is a book which one takes up with expectation of finding the regulation story of a self-made man—after the "Log Cabin to White House" style. Agreeably surprised we were to find, instead, a luminously written and copiously illustrated historical account of ore discovery and mining development in the renowned Lake Superior iron country. Done, not in the dry bones style of a professional pedant, writing history as a *science*; but told in a series of panoramic chapters brightened with interesting biographical sketches of the pioneers and business men, who, from the time of William A. Burt's casual discovery of the iron ore in 1844 up to the United States Steel Corporation and their magnificent ore laden fleets in 1905, have made the operations in this wonderful region the admiration and envy of the industrial world.

Although primarily an account of minerals, mines, ore fleets, canals, furnaces, pig iron, and dry statistics—a subject dreary to all but enthusiastic manufactures, Mr. Williams is to be congratulated upon the skillful manner in which he has enlivened his pages with color and human interest; by weaving through it all, the attractive life story of the Hon. Peter White: a member of the American Senate, who, nearly sixty years ago, assisted in stripping the first surface ore mine in Lake Superior district, and in 1852 made history by writing out at Marquette a bill of lading for six barrels of ore—the first consignment that ever left the upper Michigan peninsula. So Rembrantesque and vivid are the word pictures, which abound throughout this unique combination of history, biography and science, that the reviewer would have little trouble in setting before the readers of "The Canadian Engineer" an eclectic story—made up of extracts, which would have all the interest of a romance. Here, selected at random, is a masterly piece of scenic description. Let the reader imagine himself in an air-ship hovering o'er the far western shore of Lake Superior:—

> Witness the ore-laden fleet as it passes out of Duluth harbor; follow it a little down the lake until it joins the squadron emerging from two harbors, to be joined by a third, defiling from Ashland. Eastward they sweep, uniting with the old guard at Marquette, bearing down upon the Sault in a mighty throng, staggering the imagination to believe that they are plying on waters that knew only the birch-bark canoe scarcely half a century ago. Ask what genii is it that has rubbed Aladdin's lamp to such purpose, and the answer is "Iron." Onward they sweep, and debouching into Lake Huron join another detachment coming through the Straits of Mackinaw from Lake Michigan. Down Lake Huron they continue, a vast and ever-growing procession, closing in at the lower end for the passage of the Straits. Then the great parade moving steadily onward, enters the Detroit River. It is no State occasion that one beholds, but the common business of the day. Never ending, never stopping, like shuttles in some great machine they ply, making up the most impressive commercial panorama that the earth can show. Fifty millions of tons are passing in review,* 30,000,000 of it being iron ore to be worked up by countless hands to do service to mankind in innumerable ways.

Introducing this book (published by John A. Penton, who is doing for the merchant marine of the United States, what he has already done for foundry interests under the "Stars and Stripes") we have used not a few superlatives; but we decline to blot out a word; for this work by Ralph Williams is worthy of all we have said about it—and more. And since Canada is now entering upon an era of development, which in many respects will resemble that of our American cousins, it will pay every engineer and intending prospector in the land of the maple leaf to get without delay this readable volume, entitled, "The Hon. Peter White," S.G.

**British Progress in Municipal Engineering:** Being Vol. I. of National Engineering and Trade Lectures. By W. H. Maxwell. London: Archibald Constable & Co., Limited. 10½" x 7". 182 pp. (Price 6s., net.).

This work is volume I. of the series of authoritative lectures, issued under the auspices of the British Board of Trade, Colonial and Foreign Offices and foreign Governments and leading Technical and Trade Institutions: under the able editorship of Ben. H. Morgan. In a comprehensive, yet concise manner, the author covers practically the whole field of municipal engineering: I. General—road engineering and maintenance; II. main drainage, sewage disposal, destructors; III. water supply. As an example of brevity these lectures are a model of their kind.

Mr. Maxwell has taken every advantage of graphic illustration; for the 66 half-tone engravings and numerous wood cuts enable him to economize the mental energy of his readers, and hence to give more time and space to principles and to inductive reasoning upon the data furnished by experiment and the practical working of modern appliances in cities large and small. We were particularly interested in the 38 pages devoted to destructors. How to dispose of city refuse is one of the most important problems which faces the municipal engineer. Only a day or two ago we received a request from an official in one of our large eastern cities, asking us to search the files of our journal for data on refuse destructors. It was a pleasure to be able to direct our enquirer to the very latest and most reliable general statement of the case for destructors: from Fryer's first installation at Manchester in 1876 to the largest in the world—at Hamburg, Germany. The paper, letter press and engravings in this handsome volume are a credit to the British press; while the classified list of makers of municipal supplies, which forms an appendix to each lecture, together with the bibliography of literature on the respective themes, which terminates the course, are invaluable aids to every civil, electrical, hydraulic, and mechanical engineer, architect and surveyor who wishes to be abreast of the times.

**Graphic Methods of Structural Design.** By W. F. Pullen, Wh., Sc., M.E., C.E. Manchester, England: The Technical Publishing Company, Limited. Second edition (1905). Size 7½" x 5". 159 illustrations. (Price 5s., net.).

The fact that a "second edition" of this work on graphic statics as applied to structural des gn (specially prepared for engineers) has been called for, is evidence of its increasing popularity In our last issue we had occasion to direct attention to "rocks ahead" in the mathematical training of modern engineers, and quoted a competent recent authority on structural engineering as follows:—

> We wish to call attention to what appears to us to be a fatal tendency in the present courses in stresses in framed structures, namely, the use of too much graphics at the expense of analytical solutions of problems. Graphical methods, it is true, are time-savers in practice, but they are also brain blunters—they dull the keen edge of reason, because they make the process of solving a problem largely a process of pencil and memory. It is noteworthy that a student who has once thoroughly learned how to solve stress problems analytically, seldom forgets how to attack such problems even after the lapse of years. On the other hand, the student who has neglected the analytical method soon forgets his graphics, and is at loss without his text book to guide him. His memory has been developed at the expense of his power of reasoning.

* [Shouldn't this review cover a year's duration? Editor.]

While we endorse this expert criticism, as regards the undoubted danger of relying too much on graphics and vectors, we must stand for their great utility in the working out of practical problems. Any man who has had extensive experience in the practice of designing steel structures knows the value of these expeditious and invaluable aids. As a work exclusively devoted to graphic statics this treatise of Mr. Pullen's is the best in its class. It meets the demand voiced at recent conventions, and urged in the columns of engineering journals of the first rank, that text books on mechanics should be written by *trained, practical engineers.* This is why Mr. Pullen has been able to incorporate chapters on the "theory of counter-bracing, maximum bending moment with moving loads, design of plate girder, of masonry structures, masonry and metal arches, and the theory of structures containing redundant members." In this second edition the whole chapter on "struts" has been re-written, and as an example of natural selection of material for exposition, and inductive reasoning thereon, is simply ideal, and has greatly enhanced the practical value of the book. In the 19 pages of appendix are some excellent hints on the making of stress diagrams, etc. Our advice is, get it.

## NEW BOOKS RECEIVED.

**Science and Hypothesis.** By H. Poncaré, member of the Institute of Paris, with preface by J. Larmor, D. Sc., Sec. R.S., Lucasian Professor of Mathematics in Cambridge University. London and New York: The Walter Scott Publishing Co., Limited. Size 7½" x 5¼". 244 pp. (Price 3s. 6d.).

**Graphic Methods of Engine Design.** By Arthur H. Barker, B.A., B.Sc., Senior Whitworth Scholar, etc., 287 Deansgate, Manchester. The Technical Publishing Company, Limited. Size 7¼" x 5". 210 pp. (Price 3s. 6d. net.).

**Strength of Beams, Floors and Roofs.** (An Elementary Treatise, Prepared Especially for Carpenters and Builders.). By Frank E. Kidder author of "The Architect's and Builder's Pocket Book." New York: David Williams Company, publishers. Size 8⅛" x 5⅝". 222 pp. 168 illustrations. (Price $2.00.).

**From Morang & Co., Limited, Toronto.**

**Elementary Experimental Mechanics.** By A. Wilmer Duff, M.A., D. Sc. (Edin.), Professor of Physics in Worcester Polytechnic Institute, Worcester, Mass. Size 7⅝" x 5¼". 267 pp. (Price $1.60, net.).

**Restrictive Railway Legislation.** By Henry S. Haynes. Size 8" x 5⅜". 355 pp. (Price $1.25, net.).

**The Road Builders.** By Samuel Merwin, with illustrations by F. B. Masters. Size 7¾" x 5⅜". 313 pp. (Price $1.50).

**From Spon & Chamberlain, New York.**

**Principles of Electrical Power** (Continuous Current). By A. H. Bate. Size 7½" x 5¼". 204 pp. 63 illustrations. (Price $2.00.)

**Electrical Instruments and Testing.** By N. H. Schneider. Size 7½" x 5¼". 199 pp. 105 illustrations. (Price $1.00.).

**The Diseases of Electrical Machinery.** By Ernest Schulz. Size 7½" x 5¼". 84 pp. 42 illustrations. (Price $1.00.).

## CATALOGUES RECEIVED.

LUBRICATORS.

The 1905 catalogue of the Detroit Lubricator Company, Detroit, Ill., U.S.A., is graphically descriptive of the various kinds of lubricators which this company manufactures, and the half-tone engravings show clearly the many styles. 6 x 9, pp. 64.

GLOBE VALVES.

The Wm. Powell Co., Cincinnati, Ohio, U.S.A. The special feature of Powell's valves is the reversible, regrinding disc; the booklet which they publish describes same lucidly, and shows sectional views of the valves. 3 1-2 x 6 1-4, pp. 15.

ELECTRIC APPLIANCES AND NOVELTIES.

The six pamphlets sent us by John Forman, 708-710 Craig St., combine quantity with quality. They describe and illustrate various kinds of electric heating appliances, and novelties; tie pins, etc. Amongst the lot is a unique little device, giving two yards of testimony received by the American Electrical Heater Co.

STEAM HAMMERS.

The David Bell Engineering Works, Buffalo, N.Y., U.S.A., Bulletin No. 805 gives a brief description, together with a fine half-tone engraving, of their new improved steam hammer. 9 x 12, pp. 4.

FIREPROOF SHUTTERS, DOORS, ETC.

A. B. Ormsby, Limited, Queen and George Sts., Toronto, Ont. Fireproof doors and shutters are a new idea in Canada, and Messrs. Ormsby have excellently shown some of their manufacture, together with other pressed steel work, in their handsome catalogue. 10 1-2 x 6 3-4, pp. 88.

INTEGRATING WATTMETERS.

Canadian Westinghouse Company, Limited, Hamilton, Ont. Instruction book No. 5057 gives complete instructions for the installation and care of Westinghouse, Type B., self-contained, integrating wattmeters. Illustrated. 6 x 9, pp. 15.

ELECTRIC LAMPS.

The Nernst Lamp Co., Pittsburgh, Pa., U.S.A. "The Nernst Central Station Bulletin" is the title of a little monthly which will be found of great interest to anyone interested in electric lighting. 7 3-4 x 10 1-4, pp. 8.

WATTMETERS.

Illustrated directions for testing and recalibrating type "B" Gutmann Wattmeters for alternating current, are given in bulletin No. 1, issued by the Sangamo Electric Co., Springfield, Ill., U.S.A. 6 x 9, pp. 10.

INDUSTRIAL ENGINEERING.

The Industrial Engineering Co., 32 Broadway, New York, N.Y., U.S.A., are placing themselves before the public through the medium of a fine catalogue, picturing and describing the many kinds of machines they recommend when designing plants; together with several engravings of shops designed. 6 x 9, pp. 22.

AIR AND GAS COMPRESSORS.

We have just received from the Laidlaw-Dunn-Gordon Company, Cincinnati, Ohio, U.S.A., their comprehensive catalogue L-510, in which many kinds of air and gas compressors are described and pictured. This catalogue contains much valuable information regarding compressors. 6 x 9, pp. 175.

PYROMETERS.

Le Chatelier's Pyrometer, of which Charles Englehard, 41 Cortlandt St., New York, is the representative, is given an excellent description in a catalogue received. This catalogue gives valuable data as to temperature determinations of metals. 5 3-4 x 9, pp. 34.

STEAM TURBINES.

De Laval Steam Turbine Company, Trenton, N.J., U.S.A. The engravings and descriptions of the steam turbine, as given in the booklet published by the above company, are of the best. Many of the uses to which the turbine can be put are shown in this booklet. 3 1-2 x 6 1-2, pp. 20.

LATH MILL MACHINERY.

The Wm. Hamilton Mfg. Co., Ltd., Peterboro, Ont., has just published a very complete list of lath mills and bolsters, suitable for sawmills; illustrated. 6 x 9 3-4, pp. 12.

ELECTRIC FURNACES AND ROCK CRYSTAL APPARATUS.

Charles Engelhard, 41 Cortlandt St., New York, N.Y. The electric furnace, for laboratory use, and apparatus made from melted rock crystal, are adequately set forth in two circulars recently published. 8 3-4 x 11 1-4, pp. 14.

ELECTRIC STORAGE BATTERIES FOR RAILWAY SIGNAL SERVICE.

The Westinghouse Machine Co., East Pittsburgh, Pa., U.S.A., are making a specialty of storage batteries for railway signal service; and their manufactures in this new and important department are set forth graphically in a pamphlet which is a model of its kind, for the ten illustrated pages, picturing unformed grid, formed plate, elements, battery, type positive and negative groups, portable sets, and diagrams of discharge capacities, etc., are supplemented by only two and a half pages of descriptive writing. The storage battery is what the engineering world is eagerly waiting for. Here are the first fruits of scientific research and experiment, briefly but clearly described in a booklet, 5 1-2 x 4 1-4, pp. 16.

EXPANDED METAL.

The Expanded Metal and Fireproofing Co., Limited, 100 King Street West, Toronto.—The eight-page monthly published by the Associated Expanded Metal Companies deals comprehensively with progress in the use of expanded metal. We received with the last issue a pamphlet showing the front of two expanded metal lockers, and upon opening same found a description of the lockers inside. 9 x 12; pp. 8.

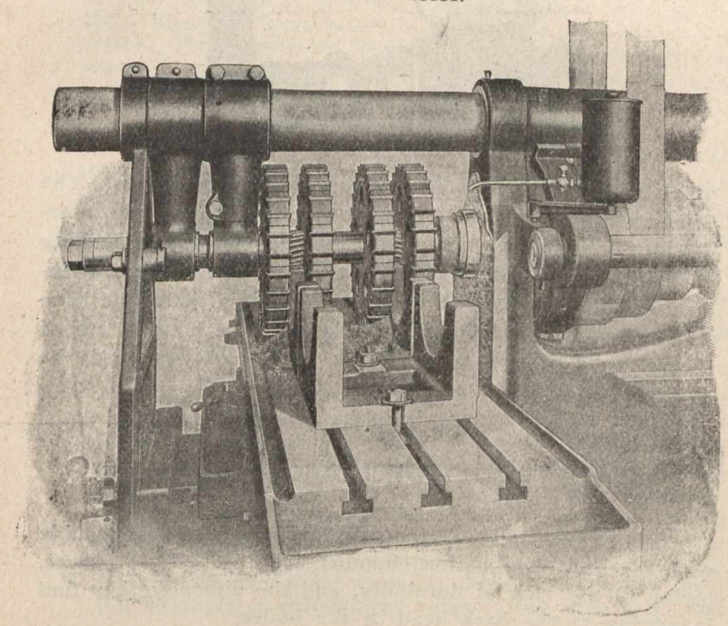
SUCTION GAS PRODUCERS.

In view of the increasing popularity of suction gas producer plants we are pleased to announce this month the receipt of a catalogue which shows to advantage, by half-tone engravings and detailed descriptive matter, the manufactures of Oscar Nagel, 90-96 Wall Street, New York, N.Y. 6 x 9.; pp. 12.

## MACHINE SHOP NOTES FROM THE STATES.

By Charles S. Gingrich, M. E.

XXI.



In these days of close competition, when the manufacturer is obliged to look very closely to the cost of his production, every tool or innovation that will reduce the shop expense, is eagerly welcomed.

The accompanying illustration shows how one of the large manufacturers in the States, by the adoption of up-to-date methods, is enabled to save two-thirds of the labor cost in machining the above castings.

These were formerly done on a 26x26 in. planer at a cutting speed of 50 ft. per minute. They will be able to finish one every six hours, but even then, owing to the tendency of the planer tool to spring the work, considerable hand-fitting was required before the pieces were satisfactory.

The illustration shows how the castings are finished in less than two hours and accurate within .001 in. on a No. 4 Plain Cincinnati Miller. Eight surfaces are machined at a single cut, removing ⅛ in. stock from each surface, the total width of the cut being 28½ in. The large cutters are 13½ in. diameter, 2½ in. face, running about 20 revolutions per minute.

This job is of special interest at this time, when the demands of manufacturers are for high accuracy and fast production, necessitating the employment of modern tools and methods.

## "GO-ESY" AUTOMATIC WHEEL CONDUIT RODS.

It is claimed that these rods possess every labor-saving feature desirable in conduit rods. They are simple in construction, and can be coupled or uncoupled instantly. These rods will not buckle or form a zig-zag line when pushed through the conduit, as they are rigid as solid joint rods.

Special provision is made making them flexible when pulled, thus allowing considerable variance when crossing a manhole, making it easy to enter another duct out of line with the first; the rods becoming rigid when pushed into the new duct.

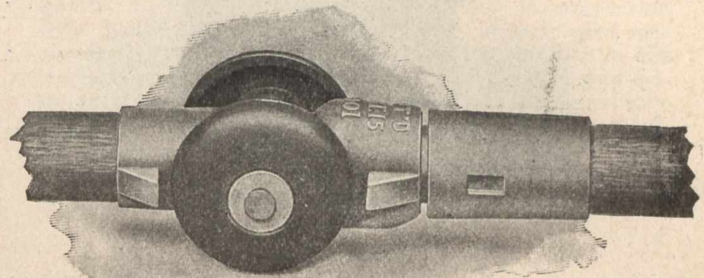
It is impossible for the rods to become detached while in a duct as the rear end of a 3-foot rod must be raised 20 inches, or to an angle of 45 degrees, before it can be uncoupled.

Heretofore in using rods with joints that can be easily detached, a loose joint was found in each case, allowing the rods to buckle when pushed through the duct, the joints pressing against the sides of the duct and causing an abnormal friction, thus requiring the combined strength of several men to push them, besides subjecting the joints to excessive wear.

The wheels serve four purposes:

First:—For preventing the rods coming into contact with the walls or floor of the duct eliminating all friction and wear, enabling one man to push with ease a set of rods 600 feet long.

As ordinarily, the section length averages approximately 400 feet, it is evident that rodding with the "Go-Esy" is light work.



Second:—They serve as a duct cleaner, each pair of wheels bringing out a quantity of dirt or mud as they emerge from the duct or pass through the manhole, leaving the duct comparatively clean. In removing the obstructions a very hard blow can be struck with telling effect on these rods, without the least injury to them.

Third:—The wheels insure 2½-inch duct opening throughout the entire section length, thus allowing a cable of that diameter to be installed.

Fourth:—The wheels are so shaped that they will always pass along easily, so long as no obstruction narrowing the duct to less than 2½ inches is encountered. The small irregularities of joints, etc., in the conduit, which causes so much trouble with ordinary rods, do not interfere when these are used. The couplings are made of bronze or malleable iron, the wheels of chilled cast-iron, and the rods of the very best hickory.

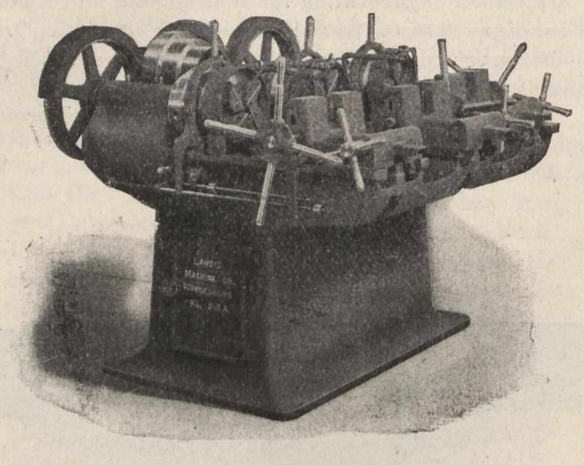
The facility with which the work can be done with "Go-Esy" automatic wheel rods makes it possible for the work to be done in less than half the time ordinarily required. A record of 20,915 feet by two men in eight hours, has been made with these rods.

They are manufactured by the Diamond Expansion Bolt Co., 9 and 15 Murray St., New York, N.Y.

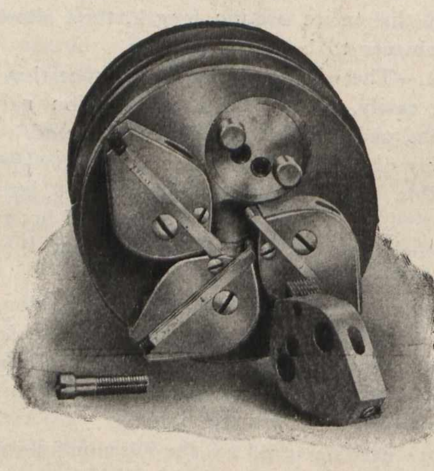
## A NEW BOLT-CUTTING MACHINE.

A new departure in bolt-cutting machinery has been made in the machine illustrated herewith. This consists principally in the entirely new and original idea employed in the die head, and especially in the chasers, although the rest of the machine is carefully designed and is strongly built.

The die has four chasers, made from flat pieces of steel, the teeth forming the threads being milled the entire length on their flat sides. The throat is formed by a bevel on the edge the entire length of the chaser. This gives uniform shape, so that the same results are obtained after each grinding until they are used to their limit, which leaves a very small piece to be thrown away. The cutting and grinding are done on the ends of the chasers. The chasers are held by grooved blocks, which are secured to four oscillating spindles, which are geared together in the head, and are made to operate simultaneously to open and close the die and to adjust it to the proper size. These blocks are interchangeable, fitted to hardened pins, which are pressed to the spindle ends, and are secured by screws to the ends of the spindles, and can be quickly changed from one size to another. The blocks slip on and off the pins with ease. The chasers, as said, are held in grooves in the blocks, and are backed on the opposite ends, from which the cutting is done by a screw, which engages threads on the sides of slot of such length as to use up the chaser to its minimum length. A screw on the top of the block has an annular grooved head to match the pitch of the chaser, which engage the teeth of the chaser, and draw it to a seat



in the bottom as well as press it against the sides, making it rigid with the block. The spindles are connected by a central pinion, having a hole through its centre to admit the passage of rods or bolts being cut. The faces of the teeth on the spindle and pinion are very wide, giving strength and durability. The central pinion has a wheel secured to it which is engaged on its periphery by a rack seated in a ring encircling the wheel. A screw runs through this rack, which can be moved by a key furnished with the machine to set the die to the proper size. The ring carrying



the rack has a limited oscillating motion, which opens and closes the die when cutting bolts. It is oscillated by a sliding ring on the head, which operates through a rack secured to the ring, a pinion seated in the head, which in turn engages a gear-toothed head on a pin connecting two toggle links, one of which is connected to oscillating ring and the other to the head. When the die is closed the links are on a straight line with each other, and make a positive lock of the die, without any tension whatever on the sliding or wearing surfaces. The racks, gearing, links and pinion are all enclosed within the head, and it is impossible for cuttings, scale or chips to get to them. This machine is manufactured by the Landis Machine Company, Waynesboro, Pa.

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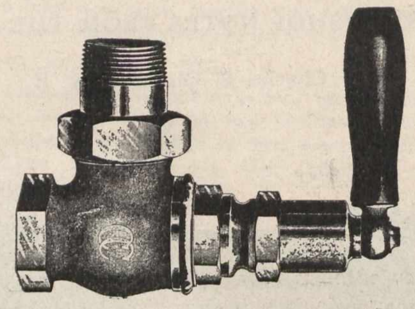
## QUICK OPENING, SELF-PACKING RADIATOR VALVES.

The valve shown on this page will doubtless be of interest to users of radiator valves. The self-packing feature precludes any possibility of leaking at the stuffing box. By a special device in the stuffing box the packing is automatically kept tight, and lasts for years. The arrangement is very simple; consisting of a vulcanized washer, which is located in top of stuffing box, the wear being taken up by spring compression. The valve is opened and closed by a half turn of the lever handle, thus making either operation very rapid. The lever can be operated by hand or foot. The quick opening and closing feature, will, no doubt, be ap-



preciated by users who have operated radiator valves. The construction of this valve is such that the bonnets are interchangeable with the bonnets of Crane regular valves, making it easy to equip old valves with the new and important improvements. In design the valves are very artistic, and have a rich appearance, being nickel-plated. The handles are of cherry wood painted a deep black. Full particulars may be obtained by writing the Crane Co., Chicago, Ill.

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## A BACK ARCH FOR BOILER FURNACES.

Stationary engineers generally have more or less trouble with the back combustion chamber arch of boiler furnaces, owing to the lack of durability, and the difficulty they find in getting at the back head of the boiler.

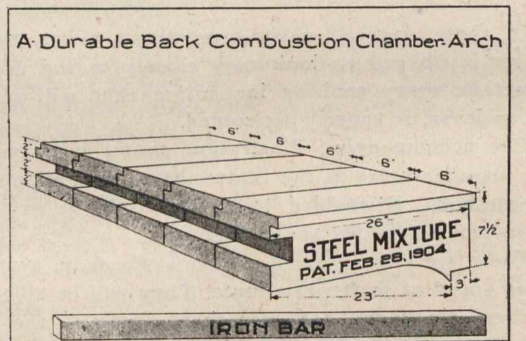
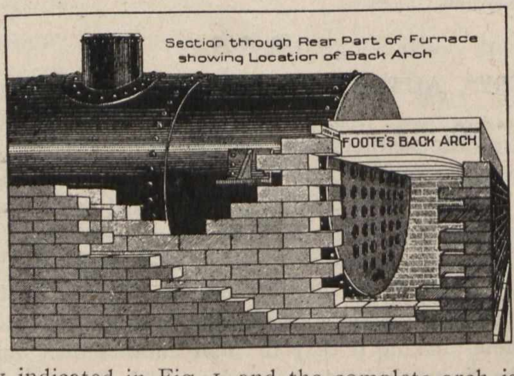



Fig. 1.

It is claimed that the back combustion chamber arch illustrated in Fig. 1, is far more durable than any design hitherto applied in boiler furnace construction. The arch is made up of a plurality of elongated firebricks, each of which is provided with a rabbet or groove along one edge adapted to fit into the rabbet in the neighboring bricks. One end of the brick is made to fit the back wall of the furnace, while the other is grooved to fit a bar of iron which rests on the side brickwork of the furnace, as shown in Fig. 2. Details showing this groove and iron bar are




clearly indicated in Fig. 1, and the complete arch is graphically pictured in position on Fig. 2.

The brick itself is made of composite material, termed "Steel Mixture," and it is said to be very superior as regards its refractory properties to the ordinary firebrick.

To those familiar with boiler furnaces, the advantages of this device will be at once apparent, the ease with which this arch enables the attendant to get at the back head of the boiler when tubes have to be expanded or replaced being a manifestly economical and time-saving feature.

The advantages of this patented, durable back combustion chamber arch are worthy of investigation by all progressive Engineers.

## THE IDEAL STATIONARY ENGINEER.

Being part of an address delivered at the Chatham Banquet of the Canadian Association of Stationary Engineers, (August 23rd), by F. B. Utley, Advertising Representative of the Goldie & McCulloch Co., Galt, Ontario. The lecturette was illustrated with chalk sketches: which, in a reduced form, we are enabled to reproduce from pen and ink sketches artistically done by Mr. Utley.

The speaker began by strongly emphasizing the fact, that the Canadian Association of Stationary Engineers was a non-political society, and in no sense a labor union. As he understood it, the aim of the organization was the mutual improvement and advancement of stationary steam engineers; and as such, was worthy of the confidence and hearty co-operation of all engineers, and ought to be recognized and appreciated by owners and operators of steam plants.

Having been associated with various classes of mechanics for a number of years, I have learned to divide the men of this responsible and honorable craft into two classes:—Mechanical mechanics and intelligent mechanics. A mechanical mechanic is one who performs his work in a machine-like manner: does simply as he is told. An intelligent mechanic is one who not only does his work because he is told to do it, but knows the reason *why* the work must be done in a certain way. For example; a mechanical sailor is one who turns the

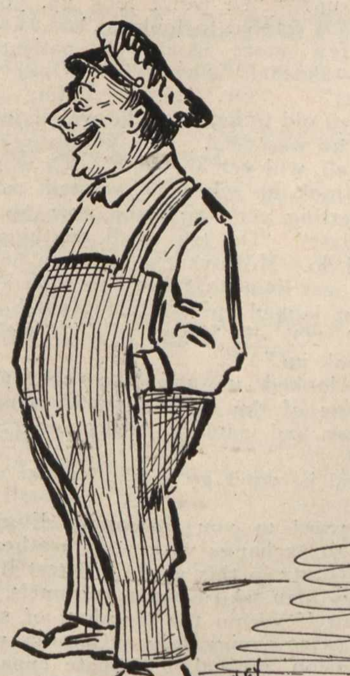
He Took no Pleasure in His Work.

steering wheel in a given direction, because he has learned from experience and observation that such a movement will direct the vessel in a certain course. An intelligent sailor turns his wheel in a certain direction because by study and reflection he knows that the mechanical connection between wheel and rudder is such as to produce a certain action upon the rudder which in turn establishes an off centre resistance in the water and directs his craft in the desired course. The work of the intelligent sailor is thus a delight, for he not only has the satisfaction of seeing the results of his labors, but he has the mental pleasure of knowing *why* the ship so readily responds to the turn of the wheel.

No employer wants to hire an engineer in whom he has but little confidence. No employer wishes to mentally carry 100 lbs. of steam anxiety with regard to the boiler and engine room, in addition to the executive pressure of his business. When he employs an engineer he wants one on whom he can rely, and to whom he can give the entire responsibility of the steam plant. The day has passed when, to shove in the furnace 4-ft. cord-wood, or pile in shovelfulls of coal; see that the water is a certain height in the gauge glass; put a little oil on the engine bearings, open the throttle and "start up," would constitute the qualifications of a stationary engineer. To-day it is not enough for an engineer simply to know that the opening of the throttle valve will start the engine, but he must know *why* the engine starts as the result of such action. He should know the construction of the valves and the effect of steam action upon them. He should know every steam port, inlet and outlet. He should be familiar with every valve, pipe and connection about the plant. It does not follow, however, that this knowledge should make him a "Tinkerer." As I understand it, the work of the Canadian Association of Stationary Engineers, is to make intelligent engineers, to make them capable of filling, and holding positions of trust. When a man can perform his duty intelligently, he is conscious of a satisfaction in connection with it, not obtainable when the duty is performed mechanically. Every engineer should take pleasure in his work. There should be a sort of friendship existing between him and his engine. If a man is not pleasurably interested in his work he should seek other employment.

Everything Goes Wrong with Him.

Life is too short to engage in services in which one cannot take pleasure. Let me illustrate this truth by sketching a man who takes pleasure in his work, and one who does not, and you will perceive at once the effect this has upon other people as well as upon himself.

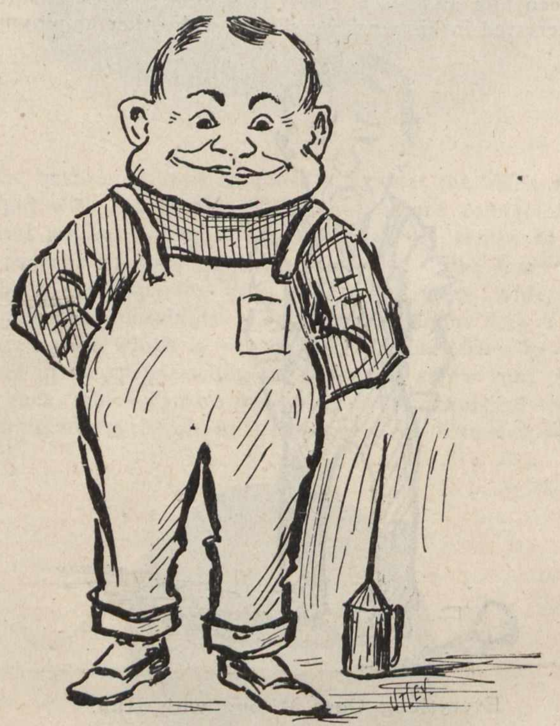


The Man with a Smile is the Man Worth While.

After making the sketches he said;—People who do not do their work in an intelligent way, sort of go it blind. I do not believe in going it blind. This reminds me of a story told by an engineer in Chicago, which will illustrate my point in the matter of going it blind, and will indicate the difficulties that sometimes result from so doing. It appears that on the west side of Chicago there lived an old Irishman, so mean that when he died no one would go to his funeral. The family felt this very keenly, so resorted to the old Jewish custom of hiring mourners. They employed two Irishmen to follow the hearse; the stipulation being that they should go along with their heads down and not look up, apparently feeling very sad. The agreement was easier than the fulfillment of it. All went well for a few blocks, but it became quite tiresome to the muscles in the cervical region of the vertebrae. The following conversation took place:

"Tim!" "Phwat!" "Hav yez looked up?" "Oi have not." "Will yez look up?" "Oi won't look up."

They went a little farther and Tim says: "Pat?" "Phwat?" "Hav yez looked up yet?" "Oi have not looked up!" "Well will yez look up?" "Oi won't look up, you wouldn't look up whin Oi wanted to look up."



He Always Took Pleasure in His Work.

After a few more blocks Pat says: "Tim?" "Phwat?" "Hav yez looked up yit?" "Oi have not looked up." "Well, say, does yez smell anything?" "Oi do." "Well, will yez look up?" "Oi won't look up, you wouldn't look up when Oi wanted to look up."

After a few more blocks of patient plodding, Tim says: "Pat?" "Phwat?" "Does yez smell anything yit?" "Oi do." "Moi, he must have been a bad old tinker whin he was livin' to go bad so soon after he was dead. Hav yez looked up?" "Oi hav not." "Well, will yez look up?" "Oi won't look up, you wouldn't look up when Oi wanted to look up."

It was getting very tiresome now so Pat says: "Tim?" "Phwat?" "Do yez smell anything yit"? "Oi should say Oi do. Moi, what a bad man he must have been when he was livin' to go bad so soon after he was dead. Hav yez looked up?" 'Oi hav not." "Well, will yez look up?" "Oi will if you will." "Well, Oi will." "Well, let's look up."

So they looked up and discovered that in the crowded portion of the city they had wandered away from the hearse, and instead had been following an old scavenger cart.

The moral is, don't go it blind under any circumstances.

Now a word to you Stationary Engineers. Do not be afraid to exchange with your brother engineers. If there is anything in this world I detest it is a selfish individual The man who hedges, trammels, entrenches, or closets himself within the kingdom of selfdom will soon become narrow, niggardly, miserable, mean. I believe in expansion, normal, legitimate expansion. Expansion of intellect is wholesome. Do not think that because you have a little wrinkle or idea that it is yours and yours only for all time. Do not think that you are going to lose by giving it to some one else. It is a case of sowing and reaping. Give an idea to a fellow engineer, and you do not know but he has one equally as good to return to you. Do not be selfish. Exchange ideas. You will both be benefited. Let me draw you a little word picture illustrating this point. In a field lay an old pond with its wide open mouth looking toward the heavens. Its attitude was one of receiving. It said in its selfish way, "I will receive all the showers and all the rains and all the torrents. I will let the land run all its drains into my body. I will hold this water against the hot summer days when they shall come. If I do not gather and save these rains, I shall dry up and there will be nothing left of me.' But far up in a mountain top started a tiny stream. Its pure sparkling waters ran down over rocks and stones with silvery laugh as it wended its serpentine way down the mountain side through the meadows, through the vales, joined by other springs and rivulets. On it went under the roadways, through the woods, and finally down by the old pond. The old pond said, "Whither away, little stream?" The stream replied, "I am going to the creek, then we shall join the river, and down with the river we will go to the larger river, and on and on till we reach the ocean, and thus help to swell the mighty tide of that vast body of water.' "Ho! Ho!" laughed the pond. "A little thing like you talking of swelling the ocean's vast expanse. You had better turn in with me for when the summer sun comes, you are so tiny you are so small, you will be all dried up, there will be nothing of you." But the little stream said, "No! I will flow on. I will give to others and they will give to me and our united efforts will serve to combat the vaporing efforts of the hot summer sun, and I shall go on to the ocean." The summer came, and what of the pond? Lying with its vast mouth ever open, ever receiving, never giving, the hot sun dried its waters and it became filled with all kinds of croaking, slimy creatures. Cattle came to slake their thirst, but turned in disgust from its putrid offering. Miasmatic germs were wafted by the winds over the neighboring country, carrying with them disease, destruction, death. But what of the stream? As it ran down the mountain sides and through the meadows watering the grasses and flowers, feeding the roots of the trees, the birds came and bathed in its eddies, the cattle came and drank from its sides, and the trees bent over and arched their boughs, protecting it from the hot scorching sun. On it went giving to others, and on and on until it reached the ocean. Then the sun picked it up in a silvery cloud where it hovered for a time over the ocean till the warm breeze came and carried it back to the mountain top where the cold air tipped the cloud cup and rain drops fell again into the little spring that had started before, and again it went on and on giving and receiving and singing as it went,—"Ponds may come and ponds may go, but I go on forever."

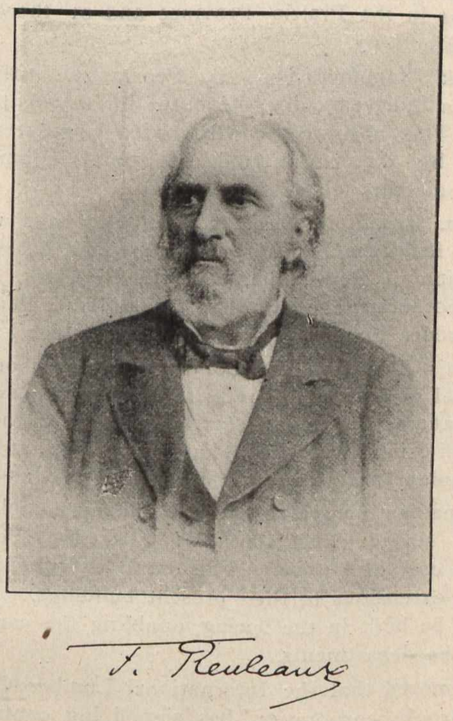
I will leave it for each of you to determine as to whether you shall be a pond or a stream. (Applause.)

## PROFESSOR REULEAUX.

In the death of Professor Dr. Franz Reuleaux, at Berlin, Germany, August 20th, 1905, at the age of 75, the engineering profession on both sides of the ocean has experienced a distinct loss.

Born September 30, 1824, at Eschweiler, near Aachen, in Germany, Franz Reuleaux was the fourth son of Johann Josef Reuleaux, the founder of one of the early machine shops of Germany. His natural inclination towards the subject of mechanics was most fortunately developed under one of the ablest of German engineering instructors, the famous Redtenbacher, then professor of machine design at the Karlsruhe Polytechnic School, and the friends of Reuleaux himself know with what mingled reverence and affection he always spoke of his early master in the science which he himself so fully advanced. From Karlsruhe the young Reuleaux went to the University of Berlin and to the University of Bonn, there pursuing the broad course in philosophy.

In 1856, being then but twenty-seven years of age, Reuleaux was called to the professorship of mechanical engineering in the Zurich Polytechnikum, and here for twelve years he formed one of that energetic band of scientific engineers which did so much to create the fame of that institution It was at Zurich that Reuleaux developed his science of machine design, and there he wrote his first great work, "The Constructor," modestly called by him a handbook of machine design, but destined, in continually enlarged editions, and through translations into French, Swedish, Russian and English, to revolutionize the practice of machine design everywhere. The first edition of "The Constructor appeared in 1861, and this was followed in 1875 by what is doubtless his most original work, the "Theoretical Kinematics." This remarkable work is nothing more nor less than an attempt to bring the entire science of mechanical movements into a systematic form, this plan involving the invention of a new notation, permitting any combination of parts to be represented by a written formula, so that, however, deeply the actual mechanism might be concealed within the construction, its identity would be fully revealed simply by writing its obvious formula. In this work some vital and fundamental principles were brought out



for the first time, a single example of which will serve to illustrate. Thus, in the case of a revolving crank with a connecting rod joining it to a rocker arm, the older writers considered this simple combination composed of but three parts. Reuleaux, however, perceived that the frame or bed-plate, or even the floor, by which the axes of the crank and the rocker were held in their positions, formed a fourth member, the whole thus consisting of a closed chain, or circuit, of which any member might be considered fixed and others free to move, and the various "inversions" of such a system lead to interesting combinations. The conception of "centroids," and numerous other illuminating features, as applied to machine design, render this an epoch-making treatise for the thoughtful engineer. The "Kinematics" has been translated into Italian, French, and English, the English translation, by Sir Alexander Kennedy, being especially noteworthy.

From the beginning of his work Reuleaux placed reliance upon the use of working models as illustrations of mechanical conceptions, and visitors to-day to the Zurich Polytechnic may find in the cabinets some of the early models made and used by him. At Charlottenburg this feature of his work became greatly extended, and the Reuleaux cabinet of kinematic models forms a noteworthy portion of the equipment of that institution. Copies of many of these models have been made for other educational institutions, the most complete being at McGill University, Montreal, and at Cornell Universiy, at Ithica.

(H.S.S. in "American Machinist.")

—Aluminum is now being used to some extent as a pattern metal, the former difficulties connected with soldering it having been solved. The most satisfactory alloy for soldering consists of 1 part of aluminum, 1 of phosphor tin, 11 of zinc and 29 of tin. To avoid loss of the more easily volatile of these metals the aluminum is melted first, then zinc is added in small pieces, then tin in small pieces, and lastly the phosphor tin. For the soldering no acid is used, but the surfaces to be joined are first covered with a thin coat of the solder in the usual way, and then brought together and heated with the soldering copper or a blowpipe or torch until the solder already upon them is melted, when pressure is applied and the joint is made. Aluminum must be heated to about 660 degrees F. before it can be soldered.

## A RECORD IN SHAFT SINKING.

The deepening of the shaft of the Acadia Coal Company at Stellarton, Nova Scotia, from the 982-ft. level to the 1,110-ft. level, or a gain of 128 feet in the twenty seven working days in August last, establishes a rather unusual record of progress in shaft-sinking. In comparing it with other instances of rapid shaft sinking it is important to note the considerable dimensions of the shaft, 12 ft. 4 ins. x 24 feet; the depth of the hoist, an average of 1,046 ft; and the fact that 100 feet of the depth sunk had to be fully timbered. These circumstances all contributed to reduce the speed of excavation as compared with smaller, untimbered shallow shafts. On the other hand, the contractor of the Stellarton work had the advantage of an unusually speedy and efficient hoisting plant. With all said, however, the record of progress quoted is a notable one. In connection it will be of interest to note another example of rapid shaft sinking, which has recently come to our attention. To excavate the tailrace tunnel of the Niagara Falls power plant of the Electrical Development Company of Ontario, a 7 x 20 ft. shaft was sunk 101.5 feet through shale and limestone, and, in addition 15 ft. of 7x14 feet drift was run from the shaft bottom during the month of August, 1903. The hoist in this case was small, the shaft being only 152 feet deep, and there was very little timbering.

The power plant at Stellarton consists of one hoisting engine with 20x30 in. cylinders, and parallel smooth drain 72x90 in., built by the Exeter Machine Works, Pittston, Pa. This engine makes the hoist in about 30 seconds. Also two 125 H.P. Sterling boilers, one Ingersoll-Sargeant cross-compound air compressor, with a capacity of 1,500 cubic feet of free air per minute, made by Allis-Chalmers-Bullock, Limited, Montreal, and two direct connected Sturtevant fans with a capacity of 20,000 cubic feet of air per minute.

## INDUSTRIAL NOTES.

Wakopa, Man., and Dufresne, Man., have openings for grain elevators.

The new plant of the Dominion Iron and Steel Co., of Newfoundland has been completed.

A wonderful strike of oil and gas is reported from Manitowaning, Manitoulin Island.

The International Gas Appliance Co. will erect a one-story factory in Toronto costing $6,500.

Dundas council have decided to install a filtering plant and make improvements to the reservoir.

The Southwestern Traction Co. have purchased a site for a power house at Glanworth, near London, Ont.

The Brantford Electric and Operating Co. will erect a new building in Brantford, Ont., at a cost of $10,000.

The John Bertram & Sons Co., Dundas, Ont., have taken tenders for the erection of a new foundry building.

The moisture of the atmosphere in Panama ruined $50,000,000 worth of machinery used by the original company.

The Gananoque Bolt Co. are equipping their extensive plant in Gananoque, Ont., with Chapman double ball bearings.

The London Machine and Tool Company are going to erect a $40,000 factory on Lottridge Street, Hamilton.

The Canadian General Electric Co. and the Canada Foundry Co. will erect a warehouse 140 x 40 feet in Winnipeg, Man.

The Northern Electric Manufacturing Co. will erect a factory at the corner of King and William Streets, Montreal, to cost $115,000.

The Board of Trade, Victoria, B.C., has come out with a demand for a $20,000,000 bridge to connect Vancouver Island and the mainland.

The Canadian General Electric Co., Peterboro', Ont., will greatly extend their present buildings and erect new buildings at a cost of about $400,000.

The Victoria Cement Co. are doubling their plant at Tod Creek, near Victoria, machinery being added to increase the daily output to 600 barrels daily.

The Nova Scotia Iron and Steel Co. have recently put in two automatic spike machines, manufactured by the Smart-Turner Machine Co., Limited, Hamilton, Ont.

Fire broke out in the Canada Brass Supply Co.'s works at London, Ont., recently, and completely gutted the building. The loss is $20,000, covered by insurance.

A syndicate of Minnesotans has completed negotiations for 43,000 acres of lumber lands on Vancouver Island, and will erect the largest sawmill on the Pacific coast.

The Dominion Coal Co. intend erecting several large new buildings at Glace Bay, N.S. The work will include a warehouse, machine shop, foundry, and probably a car shop.

The Wilson Publishing Co., Toronto, have placed an order with the Smart-Turner Machine Co., Limited, Hamilton, for one of their outside packed duplex pot valve pumps.

Messrs. Henrick & Pace, of Revelstoke, B.C., will install a plant for the manufacture of exhaust plants for sawmills, induced drafts for boilers and ventilating and heating systems.

The Jenckes Machine Company, of Sherbrooke, Que., have commenced work on their new factory buildings at St. Catharines, Ont., the contract having been awarded to Newman Bros.

W. J. Campbell has recently ordered from the Smart-Turner Machine Co., Limited, Hamilton, Ont., one 15-ton and one 5-ton hand-power travelling cranes for the Ottawa Boiler Works, Ottawa, Ont.

The Canadian Fairbanks Co. have completed their contract with the Canada Car Co. for shaftings, Universal Giant hangers, Oneida steel split pulleys, couplings, and other transmission material.

Following the lead of the Toronto Board of Trade in 1902 the Montreal Board of Trade has decided to hold a conference of all the Canadian Boards of Trade in Montreal early in the spring of 1906.

W. K. Lowden, of the Sewer Pipe Manufacturers, St. Lambert, Que., has recently purchased from the Robb Engineering Co., Limited, Amherst, N.S., two 100 h.p. boilers and one 150 h.p. engine.

The Dominion Iron and Steel Co. has appointed F. P. Jones as general manager, vice Graham Fraser's resignation. L. J. Forget will take the place of Frederic Nicholls as first vice-president of the company.

Victoria, B.C., has awarded the contract for the supply of electrical machinery for street lighting purposes to the Hinton Electric Co. The plant is to be manufactured by the Canadian General Electric Co.

The Canada Car Company will commence next month the construction of a thousand cars for the Grand Trunk, and after their completion construction work will be begun on 2,000 freight cars for the Grand Trunk Pacific.

The Dominion Bridge Company, in view of the volume of Western business and extensive railway construction sure to take place west of Lake Superior almost immediately, have decided to establish a plant and yards in Winnipeg.

The contract for the erection of the steel and concrete bridge to be erected at Edmonton, Alta., has been awarded to Charles May, Edmonton, and Charles Sharpe, Winnipeg, Man.

The Hamilton Bridge Co., Hamilton, Ont., have received the contract for two bridges, one over the Muskoka river at Bracebridge, Ont., to cost about $14,000, and the other at the outlet of the Lake of Bays, and is to cost $3,100.

The Jenckes Machine Co., of Sherbrooke, Que., have placed an order with the Pedlar People, of Oshawa, for nearly eight hundred squares of corrugated galvanized roofing, to be used in covering their new plant at St. Catharines, Ont.

The Dominion Bridge Company has decided to establish a branch plant in Winnipeg for the manufacture of steel. This decision was arrived at after careful consideration of the conditions in the Prairie Province and of the outlook for continued activity.

The Beck Manufacturing Co., Penetanguishene, Ont., is installing a Sturtevant dry kiln outfit for drying pail and tub staves. This apparatus consists of a large steel plate fan, driven by direct-connected horizontal engine, and drawing the air through a heater.

The Wm. Hamilton Manufacturing Co. have recently filled orders for their Samson turbine water wheel from the corporation of Revelstoke, B.C.; G. R. Clark, Dawson City, B.C.; corporation of Orillia; the Rolland Paper Co., the St. Lawrence Power Co., and the Trent River Paper Co.

The Adair Manufacturing Company has been organized with a capital of $75,000 to erect iron works in Revelstoke, B.C., and manufacture the patent Adair stump burner. The company will establish a foundry and iron works, and undertake the manufacture of airtight heaters as well as burners.

The Canadian General Electric Company completed the purchase of several lots south of their big Peterboro' works, at a cost of $20,000. The extra land acquired will be used for extensions to their present buildings. The additions will be built in the spring, doubling the capacity of several of the departments.

It is rumored that the International Lumber Company, a Backus-Brooks corporation, has signed big contracts for logs this winter, to be banked on Rainy Lake, where, next spring, they will build a large sawmill. It looks as if a railway were going that way soon.

The Caledonian rink has been sold to the Toronto Type Foundry company for $25,000 by the Caledonian rink company, whose capital stock was $18,000. The Toronto Type Foundry Company takes possession at once and the property will be used for the purposes of that business.

The Toronto Street Railway Company have purchased two thousand tons of steel rails from the Lorraine Steel Company of Pennsylvania. These are the heaviest metals employed on street car work, being of the grooved pattern, sixty feet in length each, and weighing ninety-six pounds.

The Niagara Construction Co., Niagara Falls, Ont., have placed with the Prometheus Electric Co., New York City, an order for a complete electric kitchen sufficiently large to prepare meals for fifty persons, and which will be used on the occasion of the opening of the new power station of the Ontario Power Co.

A company capitalized at $40,000 has been formed to manufacture the Niagara High-grade Gas and Gasoline Engine, now being manufactured by G. C. Brooks, Falls View. The company, composed of local and Niagara capitalists, expects to locate the plant at Niagara-on-the-Lake. Concessions are being asked from that town, and a vote of the ratepayers will be taken. If the by-law carries, the new company will begin manufacturing at Niagara the first of the year.

The Canadian White Co. have been awarded the contract for the new head office of the Federal Life Assurance Co., Hamilton. This building will be an eight-story modern, steel construction, fire-proof structure. The company takes the entire contract, and turns the building over for occupancy not later than August 1st, 1906. Messrs. Finley & Spence, Montreal, are the architects.

The Hart Corundum Wheel Company and the Canadian Corundum Company of Hamilton, have amalgamated under the name of the Canadian Hart Corundum Wheel Company, with a capital stock of $75,000. The applicants for the charter were the following: Charles D. Warren, Toronto; C. S. Wilcox, George F. Webb, Harley E. Sherk, directors, and Andrew S. Devine and F. H. Whitton.

Three large orders have recently been received by the Westinghouse Machine Company, of East Pittsburgh, Pa., for their Roney mechanical stoker. One order from the Jones & Laughlin Steel Company, of Pittsburgh, Pa., calls for sixteen 114 in. x 24 in. grate stokers, one from the Lehigh Valley Traction Company, of Philadelphia, Pa., calls for eight 130 in. x 20 in. grate stokers, and another from the Pressed Steel Car Company, of Pittsburgh, Pa., covers six 100 in. x 20 in. grate mechanical stokers. These stokers are of the inclined rocking grate type, with removable fuel plates, and are provided with the necessary actuating mechanism for automatically controlling the motion of the grate bars and the supply of fuel. They will be capable of burning low-grade bituminous coal efficiently, and without smoke.

## RAILWAY NOTES.

The C.P.R. will begin immediately to construct a line of railway into the town of McLeod, Alta.

The St. John Street Railway Company are installing a new 600 k.w. generator to be used for lighting purposes.

Engineers of the Grand Trunk Pacific Railway are preparing plans for necessary dredging at Fort William, Ont.

Mr. A. J. Rossar has been appointed to take charge of the construction work of the C. N. R. west of Edmonton.

The old car shops of the Canadian Pacific Railway Co. at Winnipeg, Man., was destroyed by fire. Loss about $30,000.

The C.P.R. are installing an electric light plant at Brandon, Man., which is expected to be completed early this month.

The C.P.R. are installing a Parsons steam turbine and another 500 k.w. Westinghouse generator in their power house at Fort William, Ont.

The Esquimalt Marine Railway Co., Victoria, B.C., have been awarded a contract for building and maintaining a wrecking plant for that Province.

The Canadian White Co. has been awarded a contract for the new car sheds of the Montreal Street Railway Company. Messrs. Marchand & Haskell, architects.

The Canadian Pacific Railway Co. will build a steel bridge across the river at Lethbridge, Alta. The structure will be 900 feet long and 350 feet above the water level.

At Parry Sound a by-law to give a bonus of $25,000 to the James Bay Railway Co. to establish a divisional point and erect machine and car repair shops at that place was defeated.

The London, Ont., city council adopted a by-law giving the street railway company the right to build the Edward Street belt line, which adds a mile and a half to the city's trolley system.

The C.P.R. is erecting a new machine shop at Peterboro' covering an area of 100 x 60 feet. It is considered necessary for the repairs of locomotives in service between Montreal and Toronto.

Wm. H. Moore, of Nelson, B.C., is promoting a scheme for the construction of an electric railway from New Westminster, B.C., to Spencer's Bridge, on the Thompson river, about 100 miles in length.

It has been announced that the Dominion Iron and Steel Co. have received an order from the Grand Trunk Pacific for steel rails to the amount of $4,000,000. The delivery is to extend over a period of five years.

The Dominion Atlantic Railway are now operating the Midland Railway in connection with their system.

The Canadian Pacific Railway Co. will build a branch line of 122 miles from a point in the vicinity of Wolseley, on the main line, to Reston, Man., on the Souris branch.

E. J. Haines, who is working on the Hamilton, Ancaster and Brantford Railway, reports that everything is ready to start the construction work on the line, and he is expecting authority to go ahead with the work.

Parry Sound voted to spend $20,000 to improve the electric light plant, and to grant a bonus of $25,000 to the James Bay Railway, who agree to make Parry Sound a divisional point and erect machine and repair shops.

The street railway directors of London elected F. D. Benson secretary-treasurer. No manager will be appointed. The directors will govern the road. It has been decided to spend a large sum in completely remodelling the entire system.

The city of Winnipeg sold for taxes property of the C. N. R. on which they claimed exemption, and the railway company is now suing to have the sale annulled. The sale was to Wm. Bell & Co., estate agents, for $15,000, the amount of the taxes.

It is understood that a big London syndicate is being formed to retail the Canadian Pacific Company's land. It is stated to have bought 900,000 acres of C.P.R. land at Edmonton. Shares in this syndicate are stated to be already largely over-subscribed.

Wm. Downie, general superintendent of tht C. P. R., has gone to Edmundston to inquire into complaints being made about the winter train service of the C. P. R.. The people there strongly object to the proposed arrangement and have vigorously protested.

The Provincial Government has shifted to the Temiskaming Railway commission the control of mineral locations on the right of way, and those on the town site of Cobalt, the income to be used on the railway. When C. B. Smith returns from Europe he will have a number of applications to deal with. One near Cobalt is very rich, but would require a tunnel under the tracks.

More railway development is promised for the Niagara district. A company has been formed, called the Buffalo, Toronto & Niagara Railway company, to build and operate a railway line from Niagara-on-the-Lake to St. Catharines and Port Colborne. It will touch Port Erie. Application is to be made for incorporation by the company at the next sitting of the Parliament of Canada.

The C.P.R. has placed an order with the Locomotive and Machine Company, of Montreal, for the construction of thirty-five locomotives, which may be used for both freight and passenger service. They are of the Canadian Pacific "700" class, and are of the same style as those recently built by the Locomotive and Machine Company for the C.P.R. They will be turned out at the Longue Pointe works.

It is reported that the biggest railway deal in the history of Winnipeg is about to be consummated. The project, it is said, involves the location of terminals for the Great Northern and Northern Pacific lines in the heart of the city, the depot to be only one block from the city hall. It is claimed that the right of way through the city has already been secured through the city by private purchase through local real estate men.

The first twenty-five miles of the branch easterly from Wetaskiwin, Alta., has been completed and passed by the Government inspector. The second twenty-five miles was expected to be completed and ready for operation by September 30. A contract has been let to J. D. McArthur for grading a further 50 miles easterly. It is intended to carry the line easterly to a junction with the Manitoba and North-Western Railway, which now runs to Shebo, Sask. The branch will cross the Qu'Appelle, Long Lake and Saskatchewan Railway at Saskatoon, Sask., and J. D. McArthur has a contract for grading fifty miles westerly from that point, to meet the fifty miles that he is grading easterly.

## MARINE NEWS.

A concrete bridge costing $20,000 is to be built across the Rideau river at Ottawa.

The Dominion Government will build a modern dry dock at Montreal. It will be 600 feet long and 80 feet wide.

Messrs. Whalen & Bowman, of the Great Lakes Dredging Co., Port Arthur, will erect a large dry dock at Fort William, Ont.

The Department of Railways and Canals, Ottawa, are inviting tenders for the construction of a concrete retaining wall on the Welland Canal, near Ramley's Bend.

Hon. Raymond Prefontaine, Minister of Marine, will ask a London expert to design a new ice-breaker for the winter route between Pictou and Georgetown, P.E.I.

It is said that the Government is seriously contemplating assuming control of the port of Montreal, which will mean an addition of $10,000,000 to the debt of the country. The idea is to make Montreal a free port.

M. J. Haney & Co. have constructed a $5,000 wharf at Ward's Island, Toronto, to accommodate the $100,000 worth of machinery which is to be used in the construction of the water tunnel beneath the bay. Machinery repair shops will also be constructed there.

There are now nearing completion upon the Clyde, in Scotland, for the Canadian Atlantic service, two mammoth steamships built upon original lines and designed to be among the most comfortable, safe and speedy vessels afloat. To give their patrons the best has always been the motto of the Canadian Pacific Railway, and in its magnificent new steamships, embodying the latest improvements in marine architecture, the company has raised a high standard of excellency, which will be difficult to surpass. The new steamers will be by far the largest vessels running to Canadian ports, being 14,500 tons burthen, 570 feet in length, and 65½ feet beam. They are guaranteed to make twenty knots an hour, and thus will reduce the time between Liverpool and Quebec to about six days. The interior fitttings are magnificent, and the passengers' comfort is the essential feature of their equipment, with ample room for 300 first class, 950 second class, and 1,000 third class passengers. These steamships will be called respectively, the Empress of Britain and the Empress of Ireland, and will be ready for service on the opening of the St. Lawrence route in 1906.

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## MINING MATTERS.

Canada has produced $35,000,000 worth of nickel.

Canada has the best and richest asbestos in the world.

J. P. Smith will erect a factory at Vancouver, B.C., for the manufacture of mining machinery.

Arsenical iron has been discovered on Bowen Island, near Vancouver, B.C.

The Nova Scotia Steel and Coal Co. are opening a new colliery between Sydney No. 3 and Little Bras d'Or.

W. C. Thomas has been appointed smelter superintendent of the Dominion Copper Co.'s works at Boundary Falls, B.C.

The Dominion Copper Co. will build a new smelter in the Boundary district, Grand Forks being the site under consideration.

It is said that diamonds and garnets have been found a few miles north of Sault Ste. Marie. The Ontario Geological Department will investigate.

Messrs. Mackenzie & Mann will establish a second blast furnace at Port Arthur as a result of recent mining developments in Loon Lake properties.

The Nova Scotia Steel Company has sold the abandoned works at Ferrona and the mine there for $200,000, making a better sale than had been expected.

A report comes from West Bay, N.S., that a valuable discovery of mica has been made in that vicinity. Development work shows that the mineral exists there in large quantities.

The Marion Steam Pump Company is operating a gold dredge on the Yukon river, some fifty miles up from Dawson, and is said to be making large profits. The plant is operated by electricity.

The Pilot Bay smelter, situated on Kootenay Lake, near Nelson, B.C., has resumed work after being closed since 1898. The zinc reduction works will be used in conjunction with the plant.

The Canadian Northern Coal and Ore Dock Co., Port Arthur, Ont., has recently purchased from the Robb Engineering Co., Limited, Amherst, N.S., one 300 h.p. Robb-Armstrong tandem engine.

I. Mathewson & Co., Limited, New Glasgow, have under construction a complete gold mining outfit for Newfoundland. The plant will consist of a crusher, engines, boilers, tools and concentrating tables.

The report of the directors of the Dominion Iron and Steel Co., who held their annual meeting on October 18th, shows that the earnings for five months amount to $366,062, not including the profits on the steel rail mill.

Prof. Miller, Provincial Geologist, reports an important discovery of Bessemer iron ore at Loon Lake, east of Port Arthur, Ont. It is said the deposits are much more extended than first supposed, and that the quality is of a high grade.

An output of 800 tons per day is being steadily maintained at the new mine of the International Coal and Coke Co., at Coleman, Alta., and the production can be increased at any time to 1,500 or 2,000 tons a day, as the mine, haulage system and tipple are now in a position to produce and handle a tonnage of that size should the demand warrant it.

Ontario ores are in demand in Europe. Two requests from Holland to be put into communication with sources of supply have been received at the Bureau of Mines this week. Joh. Otten and Zoon, Rotterdam, apply for information as to where they can obtain supplies of nickel, copper and iron ores, which they are prepared to buy here and export to Europe. They desire especially to obtain iron ore high in phosphorus and good nickel ore. The Antwerp Trading Company, Antwerp, is looking for cobalt ore and copper ore.

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## LIGHT, HEAT, POWER, ETC.

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

At Parry Sound, Ont., a by-law to raise $20,000 to improve the electric light plant was carried.

The Canadian General Electric Co., Toronto, are supplying electrical machinery for the Kaministiqua development at Fort William, Ont.

Port Arthur, Ont., is installing a new 4,000-light dynamo in the power house there, which will increase the capacity of the works to 8,000 lights.

The city of Kingston, Ont., has been granted permission to issue debentures to the amount of $20,000 for improvements to the electric light plant.

At Exeter, Ont., a by-law to authorize the council to buy out the electric light plant at a price not to exceed $18,000 was defeated by a small majority.

An up-to-date alternating electric light plant will be installed at Canning, N.S. A line to Kingsport and to Sheffield's Mill will be extended in the spring.

The Pembroke Light, Heat and Power Company has been formed to acquire water power on the Black river for the purpose of adding to the present electric light system.

A by-law to authorize the council of Exeter, Ont., to purchase the existing electric light plant at a price not to exceed $18,000 was defeated by eight votes on September 24th.

A new storage dam is being built at Hazelwood lake, near Port Arthur, to meet the requirements for more power.

The Welland Electric Power Transmission Co., with headquarters at St. Catharines, contemplate running power lines to Hamilton and Toronto. The company is backed by New York capital.

Canadian General Electric Co. have secured option on large tracts of land adjoining their present site at Peterboro', and propose to spend between $30,000 and $40,000 in increasing their plant.

Chatham, N.B., will apply to the Legislature for authority to issue bonds to the value of $35,000, the proceeds of which will be used in the erection and operation of a new electric light plant.

A horseshoe dam will be constructed above the crest of the Chaudiere Falls, each side paying half the cost of the same—estimated to be $40,000—and each side sharing equally in the water power.

McLachlin Bros. are negotiating for a contract to operate the water works machinery at Arnprior, Ont., by electric power. They have in view the erection of a large dam on the Madawaska river.

The company which is to undertake the development of the Kaministiqua Falls, near Port Arthur, has let contracts to the Canadian General Electric Co. for erecting equipment worth about $200,000.

A syndicate composed of Canadian and American capitalists intend developing the water power on the Assiniboine river at Brandon, Man. The intention is to erect a large power house and plant at Currie's Landing.

The Southern Light and Power Company have offered to supply electric light to the village of Weston, Ont., at $6 per 32 c.p. light per year for an all-night service. This company are now lighting the village of Streetsville.

The town council of Westmount, Que., have accepted the tender of the Robb Engineering Co., Amherst, N.S., for engines, accessories and their erection in connection with the new electric lighting plant at a cost of $8,300.

The town council of North Toronto, Ont., have appointed a committee to secure information as to the cost of installing an incandescent electric light plant. The intention is to submit a by-law to the ratepayers in January.

The new power plant at Wahnapitae is now in operation. As Wahnapitae is but twelve miles from Sudbury the intention is to supply that place with light as well. This will relieve Sudbury of the necessity for having a plant of its own, and also lessen the expenditure of both places.

The Jones & Moore Electric Co., Toronto, are opening a branch in Winnipeg. They have formed a joint stock company capitalized at $75,000, to be known as the Jones & Moore Electric Co., Limited, of Manitoba. The company have taken over the business of the Hicks Electric Co., of Winnipeg. A factory will also be erected for general repair work.

The Westinghouse Electric and Manufacturing Co. are preparing plans and estimates for the complete electrical construction and equipment contracts for the development of Eugenia Falls, on the Beaver River, which is to be constructed as a huge electrical hydraulic power plant by the Georgian Bay Power Company, of Toronto. Estimates are based on details furnished by H. Von Shon, engineer in charge.

## PERSONAL.

Edward J. Odlumbe, C.E., one of the best-known civil engineers in Canada, died very suddenly at his home in St. Catharines, Ont., recently.

E. R. Wood, who is at the head of the Central Canada Loan and Savings Co., has been appointed a director of the Dominion Iron and Steel Co.

W. B. Boyd, chief electrician, D. I. & S. Co., is touring in the United States, in connection with extensive additions to the electric plant of the steel works.

Hon. A. G. Blair has resigned his position as manager of the Henderson Roller Bearing Company.

Robert Mitchell Floyd, editor and owner of the Trade Press List, will, during the winter, be in his New York office, Coffin Exchange Building, 66 Beaver Street, Rooms 911-912.

W. E. Mellin, assistant in the engineer's department of the Grand Trunk Pacific, has resigned to accept a position in the office of Vice-President Schlack, of the Denver & Rio Grande railway.

Cecil B. Smith, engineer for the Temiskaming and Northern Ontario Railway and the Ontario Hydro-Electric Power Commissions is now in Europe gathering information. He will especially look at the electric locomotives in use in Italy, Switzerland, Germany, France and England. It is the intention of the commission to equip the New Ontario Railway with electric locomotives in the near future.

William B. Rankine, vice-president and general manager of the Niagara Falls Power Company, and also of the Canadian Niagara Company, died recently at Franconia, N.H., where he went with Mrs. Rankine a few weeks ago on a vacation trip. The deceased was the practical pioneer of power development on the Niagara frontier. It was through his indefatigable efforts that the Niagara Falls Power Company came into existence, and that the Canadian-Niagara Power Company was organized. Mr. Rankine was forty-seven years of age.

## MUNICIPAL WORKS, ETC.

A contract for a breakwater at Richibucto has been awarded to Messrs. Jardine of New Brunswick.

A contract for a breakwater at Indian Harbor, P. E. I., has been let to Messrs. Heney and Smith, of Ottawa. The price is about $100,000.

The Robb Engineering Co. recently filled orders from Westmount, Que., for two 350 h.p. Robb-Armstrong vertical engines, and from the council of Napanee for two 200 h.p. Robb-Armstrong Corliss engines, two 150 h.p. return tubular boilers and one 200 h.p. "Robb" feed-water heater. This machinery will be used for the new municipal lighting plants in these towns.

The total cost to the city of London of the land needed for the West London breakwater is $5,562. This is exclusive of what the city will have to pay for the strip of Tecumseh Park. The total expenditure for breakwater purposes sanctioned by the people last January is $15,000. This is for the exclusive benefit of West London. Of this sum more than a third has been paid to the West Londoners who are nearest the breakwater. The city had not calculated upon paying more than half that figure for the land.

The municipal gas and electric plants at Kingston show good results for the past three months. The figures for gas are:—For 1904, $7,547.51; for 1905, $6,854. The rate on gas this year was reduced from $2 to $1.50 per thousand feet. For electricity in 1904 the receipts were $6,182; for 1905, $6,034. The rates on electricity were lowered two cents per kilowatt hour. Manager Campbell says the gross revenue of the plant will soon be up to the figures before the rates were reduced, and then another cut is possible.

The last span of the superstructure of the Pillsboro' bridge has been placed in position, thus completing the main features of this structure, by far the most important ject of its kind ever attempted in Prince Edward Island. Both federal and provincial governments have contributed, and will contribute, though in very different proportions, to its cost and maintenance. The bridge will be opened to the Southern Railway about November 1,, thus giving daily communication by rail for the first time between the southeastern section of the province and Charlottetown.

The council of Kenora, Ont., has adopted by-laws authorizing the issue of $30,000 of debentures for the purpose of extending the water works system; also to cover the cost of construction of sewers on several of the streets.

The ratepayers of Stratford, Ont., will vote on a by-law to provide $56,000 for stone sewers.

The Empire Gas and Construction Co., New York, have been awarded the contract for the construction of a municipal gas plant at Guelph, Ont., at a cost of $65,000.

At Perth, Ont., the town council has passed a by-law providing for the issue of debentures amounting to $20,000 to complete the sewerage system in that place.

The city council of Montreal recently appointed three experts: Manager Pearson, of the Consumers' Gas Company, Toronto; F. Giroux, a French engineer; and E. Belanger, to consider the advisability of establishing a city gas plant.

## TELEGRAPH AND TELEPHONE

A new telephone line has been built between Canifton and Wallbridge.

The Moose Jaw Telephone Co., Moose Jaw, Sask., are laying several long distance lines.

The Saskatchewan Telephone Co., Saskatoon, Sask., are preparing to build long distance lines to several adjacent towns.

The Moose Jaw Telephone Co., Moose Jaw, Sask., are installing a Kellogg switchboard, when the long distance line between that place and Regina will be completed.

The ratepayers of the town of Dauphin, Man., have voted in favor of the establishment of a municipal telephone service, which will be installed during the coming winter.

A telephone line has lately been completed by the Bell Telephone Co. between St. Angele de Laval and Gentilly. This means that there is now a direct line between Three Rivers and Gentilly, which also connects with the intermediate villages of St. Angele de Laval and Becancour.

The Winnipeg Board of Trade has decided to agitate for the installation of a municipal telephone system, unless a perceptible improvement is immediately made in the Bell Company's present service.

## NEW INCORPORATIONS.

**Ontario.**—The Pembroke Electric Light Co. has increased its capital from $50,000 to $150,000.

The Hart Corundum Wheel Co., Hamilton, $75,000; G. E. Webb, C. S. Wilcox, H. E. Sherk, F. H. Whitton, A. S. Devine, Hamilton; and C. D. Warren, Toronto.

The Canadian Oil Refining Co., Toronto, $100,000; J. F. Hollis, T. H. Wilson, W. P. Bull, T. H. Hamilton, A. M. O'Brien, Toronto.

The Canadian Oil and Waste Saving Machine Co., Brockville, $50,000; F. E. Clayes, W. S. Buell, J. H. Botsford, G. H. Mallory, I. M. Braniff, Brockville; to manufacture machinery for separating oil waste and other materials.

The Standard Silver and Cobalt Mining Co., New Liskeard, $40,000; J. Armstrong, G. Warrell, J. Sharpe, E. F. Stephenson, and W. N. Cameron, New Liskeard.

The Brakehurst Oil Co., Sarnia, $100,000; G. M. Trefts, Buffalo, N.Y.; H. H. Cooper, Jamestown, N.Y.; J. W. Brake, J. H. Cooper, Sarnia, and J. Ferguson, London.

The Blanch River Mining Co., New Liskeard, $40,000; J. Pearce, J. Dawson, J. Adair, G. S. Royce, S. Greenwood, A. I. Ritchie, E. T. Ord, New Liskeard.

The Rothschild Cobalt Co., Haileybury, $500,000; M. Rothschild, H. M. J. Rothschild, New Liskeard; J. McKay, W. H. Hearst, J. L. Darling, Sault Ste. Marie, Ont.

The Robertson Machinery Co., Welland, $40,000; A. Robertson, C. H. Hanson, G. W. Sutherland, B. J. McCormick, H. W. McCoomb, Welland; to manufacture and deal in machinery, engines, etc.

The Federal Electric Construction Co., Brantford, $40,000; J. Ellis, York township; G. H. Kilmer, W. H. Irving, C. W. Laker, and N. Boynes, Toronto; to manufacture electric motors, dynamos, electrical machinery, etc.

Chapmans, Limited, Toronto, $80,000; A. Chapman, W. Chapman, G. A. Chapman, E. W. Trent, F. M. Chapman, and R. J. Aikins. To manufacture ice tools and machinery.

The Port Colborne-Welland Natural Gas and Oil Co., Port Colborne, $50,000; J. H. Smith, T. F. White, J. W. McCoppen, S. H. Glasgow, W. H. Best, Welland; L. Burnbull, F. K. Brown, Township of Humberstone, Ont.

The Sublime Hygienic Cement Flooring Co., Toronto, $50,000; L. P. Scarrone, L. D. Negro, P. Venier, U. Corsi, L. V. McBrady, J. Murphy, Toronto.

The Coleman Development Co., Haileybury, $300,000; J. F. Gillies, R. R. Little, Haileybury; J. McKay, Sault Ste. Marie; J. F. Hope McCarthy and W. E. Moore, Toronto.

V. J. Hedden & Sons Co., Toronto, $100,000; R. W. Berliner, H. C. Whitten, D. R. Gillie, H. W. Ivor, J. G. Coveny, Toronto. To carry on business as general building contractors.

The Northern Exploration Co., Haileybury, $100,000; F. M. Perry, S. D. Lauder, A. W. Ballantyne, M. H. Ludwig, Toronto; A. C. Boyce, of Sault Ste. Marie, Ont.

Standard Power Gas Construction Corporation, Toronto, $100,000; F. Ford, B. Osler, G. C. Loveys, J. F. H. McCarthy, J. M. Ewing, Toronto.

The Pre-Payment Electric Meter Co., Peterborough, $100,000; A. A. Hollingshead, W. Hamilton, J. H. Larmouth, J. H. McClellan, A. Parker, A. J. McClellan, Peterborough. To manufacture all kinds of electric fans, motors, meters, etc.

The Boiler Flue Cleaner and Supply Co., Toronto, $100,000; A. C. Buell, Buffalo; C. E. Adams, London; T. H. Wark, D. W. Livingstone, Toronto; E. Wilson, Hamilton.

Standard Bolt and Screw Co., Toronto, $40,000; T. Clark, Buffalo, N.Y.; A. A. Dickson, P. S. McKergow, J. Jennings, H. Millar, Toronto.

Mathews Steamship Co., $250,000, Toronto; A. E. Mathews, R. S. D. Taylor, W. B. Raymond, F. Ford and B. Osler, Toronto.

The Grand River Metal Works, of Galt, and the Canada Steel Goods Co. have amalgamated under the latter name with a capital of $115,000; Hamilton J. S. Ainslie, R. O. Y. Ainslie, Comber; A. F. Hatch, Toronto; A. Ludlam, A. G. Moffat, J. D. Ainslie, Leamington; J. S. Wardlaw, C. Cumming and G. Hancock, Galt.

**Dominion.**—"Marbelite," Limited, Montreal, $20,000; L. N. Benjamin, A. B. Keiffer, J. B. Benjamin, Lachine; H. G. Lajoie, P. Lacoste, Montreal. To deal in all kinds of cement, artificial stone, etc.

The Sovereign Construction Company, Montreal, $1,000,000; W. Cook, M. O'Meare, Montreal; H. Kennedy, M. Kennedy, Quebec; E. Dussault, Levis; L. M. Aldrich, Waterdown, N.Y.; and M. P. McGrath, Worcester, Mass. To carry on business as general contractors.

The Hill Electric Switch Co. has increased its capital from $10,000 to $45,000.

The Northern Construction Co. has been changed to the "Federal Construction Co."

The Kildare Mining Co., $100,000; Ottawa; W. W. G. Bronson, R. N. Slater, J. D. Courtenay, J. W. Woods, Hon. N. A. Belcourt, Ottawa.

The Automobile Import Co., $20,000, Montreal; A. E. H. Crawford, F. R. Crombie, W. W. Skinner, R. C. Grant, G. G. Hyde, Montreal. To deal in all kinds of vehicles, pleasure boats, etc.

J. H. Conrad, Yukon Mines, $100,000, Toronto; E. Bristol, E. Bayly, W. F. McRae, C. W. Mitchell and W. Kelly.

Standard Lime and Quarry Co., $10,000, Joliette, Que.; J.O. Dupuis, J. N. Foucher, Montreal; J. E. Théreualt, J. Laflèche and C. Noreau.