PAGES

MISSING

The Canadian Engineer

ESTABLISHED 1893.

WITH WHICH IS INCORPORATED

THE CANADIAN MACHINE SHOP.

VOL. XII.—No. 10. TORONTO, OCTOBER, 1905. PRICE 10 CENTS $1.00 PER YEAR.

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

Longfellow.

CECIL B. SMITH, C.E., Ma.E.

Member American Society Civil Engineers, Member Canadian Society Civil Engineers, Member Institution Civil Engineers, Author of "Railway Engineering."

Lord Bacon says, that there are three things which make a nation great and prosperous; a fertile soil, busy workshops, and easy conveyance for men and commodities from one place to another. A visitor from Mars to the National Exhibition, Toronto, (September 8th), had only to witness the magnificent review of horses and cattle, and to glance at the remarkable display of harvesting machinery, etc., in the halls, to divine at once that Canada is a great agricultural country: due to "a fertile soil." The recent graphic description in our columns of the imposing workshops at Davenport and Galt—all as busy as bee-hives, may be cited as proofs of Canada's rising prosperity in iron and steel. But these two factors, which make so much for the material progress of a country, would soon find their limitation, if the Civil Engineer was not in evidence with his harbors, breakwaters, docks, highways, canals, bridges, and railways; to enable the farmer, factory owner, and iron-master to transport their produce and manufactures from the fertile fields and centres of industry, to the wide-spread cities, or far distant coast. And what splendid examples of these achievements in Civil Engineering Canada can show!

"These are imperial works, worthy of kings."—*Pope.*

It is our pleasure this month, to add to our portrait gallery a brief sketch of one who stands in the front rank of Canadian Civil Engineers.

Cecil B. Smith was born in Winona, Wentworth County, Ontario, in 1865. He began his education in the public school of his native town, then attended the Hamilton Collegiate Institute, and from thence entered McGill University, Montreal, in 1881; graduating with distinction in 1884—carrying with him the Governor-General Medal. Equipped with a thorough technical education, Mr. Smith in 1884 began his active business career as resident engineer to N. & P. J. Ry., Muskoka & Parry Sound District. After two years he entered the service of the C.P.R., and between 1887-1893 gleaned invaluable experience on the great railroads of Tennessee, South Carolina, Virginia and Pennsylvania, U.S.A. Having added practice to theory, he accepted the responsible position of Assistant Professor of Civil Engineering at McGill University, which he held from 1893 to 1898. More than one young Canadian engineer with his feet on the ladder of success got the basic knowledge and inspiration for his life work under Mr. Smith's tuition. It was during this Professorate that he published his standard work on "Railway Engineering." But, perceiving the boundless development possibilities of his country, he resigned the professorship in 1898, and returned to the active field of engineering. First with the C.P.R., then the city of Toronto, and in 1901 at Niagara Falls, conjointly as Resident Engineer to Canadian Niagara Power Co., and (1902) Consulting Engineer International Railway Co. With this rich experience he left the "Falls" in December, 1904, and commenced private practice in Toronto as Consulting Engineer. Then came the flood tide.

With the advent of 1905 came the news of the proposed railway electrification in the Temiskaming district, followed by the announcement in March that Mr. Smith had been appointed chairman of the Temiskaming and New Ontario Railway Commission, and subsequently as consulting engineer for same. This honor was not unexpected by his friends, for as man of action he is typically Canadian, combining the steadiness and common sense of the Englishman with the American disdain of tradition.

His still more recent appointment by the Ontario Government, July, 1905, as Chief Engineer of its Hydro-Electric Commission, is a fitting corollary to a strenuous and honorable career. THE CANADIAN ENGINEER is certain that it voices the sentiments of its numerous readers in wishing Mr. Smith continued success in his special field of railway electrification and development of the water power resources of his native Province.

SYSTEM IN INDUSTRIAL ESTABLISHMENTS

BY A. J. LAVOIE.

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III.

ESTIMATE.

At this stage the sub-engineer is confronted with the question as to whether it is worth while to make elaborate estimate. If he conclude that it is; then by all means let it be complete and exhaustive. It is in the details where the gains or losses mostly occur; hence keen precaution should be taken to include every item, no matter how small and apparently insignificant. To miss one mark on a drawing may convert a certain profit into a deplorable loss. It may be that the only machine on which a certain operation can be performed is inconveniently located, or is engaged on some special work which cannot be delayed. Or, new tools may be needed, the necessary purchase of which will eat up the profits, because the cost was not included. These, and many other things, count in the making of an estimate.

In making any estimate, the following points have to be considered:—(1) Have you ever made an estimate on a job similar to the one before you; (2) did you ever make or manufacture said article; (3) is the quantity required more, or less; (4) did you purchase any special supplies for this previous work; and can you buy on like terms; (5) is there any change in design which will increase or decrease the weight; (6) have you got the machinery to do the work; (7) can you use these machines—probably busy on promised and important work; (8) is the machine in process of repair, and if so, when will it be ready for use; (9) what kind of mechanic can you put on the proposed job; (10) is it the man who performed the work previously, and if so, what time did he make; (11) if a new man, what can he do; (12) has the machinery upon which the previous job of like design was done depreciated since then, and if so, make due allowance. These considerations are all important if an old estimate is used.

But supposing there is no previous estimate in existence, and the weights, time, and price have all to be figured out from beginning to end; then comes the time to test the theoretical and practical knowledge of the engineer's staff, and the system in vogue.

In making an entirely new estimate, the following rules must be observed. If there is no drawing or sketch of the machine, appliance, or structure to be estimated, make either one or the other; selection depending upon the character of work. Each article on the drawing or sketch so made, to be numbered consecutively; beginning with the articles to be purchased from outsiders, followed by the heaviest and most expensive pieces. The weight of every article, or detachable part thereof, is to be accurately calculated. And without delay, issue requisition to the purchasing department for the procuration of prices of such parts, or raw material, as must be bought outside. Then—as in the previous case of verifying old estimate—enquire if the machines on which it is contemplated to do the work are free; what kind of mechanics are available to operate the machines, and finally determine the earliest possible time of delivery to customer in the event of securing the contract.

The drawing or sketch having been prepared, and the estimate completed, the estimator places original form 91 and 104, over duplicate form 92 and 104, inserts a carbon paper between the two forms, signs his name in lower left-hand corner, fills in his office number, together with date of estimate completion; also numbers of estimate, sheet and job in the respective places reserved for them.

Having stated generally the *modus operandi* of making an estimate, both with and without existing data, the way is clear for a more detailed explanation.

Assuming that no reliable data is in the files of the office and that the requisite drawing or sketch of the work to be estimated is before the estimator, the logical order of procedure is: to (1) number each article on the said drawing or sketch; (2) enquire if any of the parts required are in

*A. J. LAVOIE'S SYSTEM No. 91
ENGINEERING DEPARTMENT No. 3
● **ORIGINAL ●
A. J. LAVOIE'S SYSTEM LONGUEUIL P.Q., CANADA
SHEET No.........
ESTIMATE No.........

Nos. of Pieces	Name of Articles	Drawing No.	Article No.	Instruction Card No.	MACHINERY: Time Allowed in Minutes	Machine No.	Rate per hour	Cost of Machining	LABOR: Time Allowed in Minutes	Workman Check No.	Rate per hour	Cost of Labor

Prepared by	*Cost of Machining*		*Cost of Labor*
Date Prepared	*Burden*		*Burden*
	Total	[OVER]	*Total*

JOB No.
Approved by Superintendent
Approved by Chief Engineer

*Change this number to No. 92 for the Duplicate. **Change this name "Original" to "Duplicate" for Form No. 92.

The size of this Form is 6" x 10", printed with Red Ink on 20 lbs. Bond Paper, Amber Color. Made in Duplicate Form, Padded on Upper End only. Perforated to suit Standard Shannon Letter File.

Nos. of Pieces	Article No.	MATERIAL: Kind of Material	Weight or Size Rough	Price of Material	Cost of Material	PURCHASE ARTICLES: Name of Articles	Catalogue No.	Figure No.	Size No.	Cost of Articles	ADD TOTAL COSTS and Extras in this column		
													Cost of Machinery
													Cost of Labor
													Cost of Material
													Cost of Purchase Articles

Cost of Material	*Cost of Articles*	
Burden	*Burden*	
A. J. Lavoie's System. *Total*	**Form No. 104.** *Total*	*Total*

Machine No.	*Type of Machine*	
In Department Name and No.	*Largest piece of work it will take*	
Driven by	*Quantity of Tool Head*	*Fastest Feed of Driving Cone*
Horse Power Required	*Fastest Feed of Tool Head*	*Slowest Feed of Driving Cone*
Help Required	*Slowest Feed of Tool Head*	*Quantity of Cones on Shaft*
H.P. of Crane Required	*Fastest Speed of Driving Head or Table*	
Floor Space required in feet	*Slowest Speed of Driving Head or Table*	

A. J. Lavoie's System **No. 102. Machine** Cost Card for Burden, **Dept. No. 3**

FRONT
Printed Red on Amber Color Cards.
Use Parchment Cardboard for these Cards.
Size of Form 3 x 5.

Drawing No.	*Pattern No.*	*Material*	*Job No.*	*Instruction Card No.*
Name of Article		*Machine No.*	*Number of Pieces*	*Weight of Ore*

Operation No.	Operation in Detail	Tool No.	Cut	Feed	Cutting Speed per Minute	Mins. allowed
1						
2						
3						
4						
5						
6	FORM NO. 12.					

Date Issued ________ *Signed,*
If the work cannot be handled as above, report to foreman at once.

FRONT
Printed Red on 100 lbs. Amber Color Cards.
Use Good Quality of Stock.

Detail Cost for Burden of Machine No. 1

Cost per Hour in Detail

- **Power,** Horse Power Required
- **Help**
- **Crane**
- **Floor Space**
- **Heat**
- **Light**
- **Miscellaneous Cost**
- **Total**

In this column state the date of the Inventory and the Percentage Allowed for wear

Inventory: Date	M'h	Year	% Allowed

Original Cost of Machine

Burden Allowed $ c.

A. J. Lavoie's System No. 103

BACK OF FORM NO. 102

Operation No.	Operation in Detail	Tool No.	Cut	Feed	Speed	Mins. allowed
7						
8						
9						
10						
11						
12						
13						
14						
15						

A. J. Lavoie's System No. 11, Dept. No. 3. Instruction Card.

BACK OF FORM NO. 12

stock (see below*); (3) determine kind of material, and (4) calculate weight; (5) state price. Then mark on form 91 and 104, and 92 and 104 the distinguishing number of the article, number of pieces required, description of same, kind of material, approximate weight and price.

* When conducting enquiry (2) it may be found that a large quantity of the material required is not in stock, and that the same must be ordered outside; in that case, forward without delay requisition to the purchasing department, asking them to secure quotations from dealers straightway.

The part of the estimate dealing with materials having been disposed of, the estimator is face to face with a most important question, viz., what machines are available for doing the work, and what can be accomplished thereon. Every industrial establishment should have a complete inventory of all their machines. The original cost; wear and tear, depreciative value; together with an accurate burden record of each; beside other essential details called for on form 102 and 103. This card is not only of great value in estimating,

the estimated and actual time taken: the estimated time is written in black, the actual is inserted above in red. While as a means for general comparison, it is invaluable, since it enables the estimator of other work not precisely similar, but of like size and form, to determine with some degree of accuracy the time required to do the particular work. Besides, what a manifest advantage it must be to the management, in enabling those in authority to make accurate comparison between the work of different machines and mechanics.

In tabulating time allowance for machining, find out (1) which is the most suitable machine for doing this particular work; (2) is it overcrowded with work, and if so, can it be spared at the time the material will be ready. In any case take good care to engage a machine for the particular operations required, and record date of mutual agreement with the foreman in charge of the machine so requisitioned. Omit not to record in detail the time needed for each operation; due allowance being made for setting and all, from the time the article is conveyed by hand or crane to the

A. J. LAVOIE'S SYSTEM No. 105* PRODUCTION DEPARTMENT No. 4

PREPARED BY DATE COMPLETED

● **ORIGINAL ●

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

COST OF ESTIMATE No. .... Number of Sheets .... Sheet No. ....

OPERATIONS — COST — CHARGES

LABOR

MATERIAL

SPECIAL (give particulars)

Cost Office

BURDEN

TOTAL

REMARKS

Approved by Production Dept. No. 4 Chief Engineer

Approved by Chief Cost Clerk

Approved by Superintendent when completed

Always state Job. No. on all future correspondence, or it will be returned

JOB No.

*Change this number to No. 106 and 107 for the "Duplicate" and "Triplicate."
**Change this name "Original" to "Duplicate" and "Triplicate" for Forms 106 and 107, respectively.

The size of this Form is 6" x 10". Form 105 printed Brown on Pink 20 lbs., and 106 printed Black on Pink 20 lbs., and 107 printed Green on Pink, 20 lbs.. bond paper.

but also in annual stock-taking. A similar form has been prepared in this system, for all tools in the establishment. (See tool room part of the "Lavoie system.").

The estimator is thus provided with drawing, number of articles required, description, material, weight, and from careful scrutiny of finish marks on drawings, knows what operations have to be performed on the machines in the shops. The record of operations such as are to be done on this particular work, is to be found on form 11 and 12.

In each department where machine operations like those specified on form 11 and 12 are performed, a wise, experienced mechanic should be appointed to assist the engineer in the preparation of the practical data entered on this operation card. By so doing, the management will not only have an up-to-date estimating engineer, but also an expert intermediate for service in case of dispute where the "Bonus system" is in use.

An exceedingly useful form is 11 and 12; and very necessary for the distributive apportionment of work over the respective departments concerned—shop, machine, and labor. Indeed, it is indispensable for comparison between

machine, discharged from same, passed by the inspector, and delivered to the storage department.

The next part of the estimate is the matter of labor. Here the personal equation comes in, and much depends upon the sagacity of the estimating engineer and his advisers—the expert mechanics in the shops. Not only is the operating time to be carefully figured, but there must be consideration of the man behind the machine: his reputed ability and rate of wages. One mechanic can turn out three times as much work as another, although the difference in wages may be slight; hence the advantage of securing the machine with the triple speed man behind it if possible. But mechanics of this kind are limited in supply, and the source of a one-ply man may be all that can be counted upon, whichever is available, record faithfully.

Having gathered in detail all the various operations, fill in the data on form 91 and 92: forgetting not to include therein the charges for clerical service—duly apportioning same to the respective classes of work. Then add the totals at the place indicated at the bottom of form, then pass on for approval by the chief engineer.

Supposing there are several sheets of data, add cost of machine; labor; stock material; purchased material, together, and transfer same to estimate form 93 and 94. Supplementing this data with shipping weights and instructions—if there are any—and any additional information which may be of service to the sales division. Then have the requisition for estimate, form 93 and 94, and also estimate form 91 and 104, together with 92 and 104, approved, signed and arranged by the chief engineer who is careful to separate the originals from the duplicates, and binds each bundle with wire staples, so that all the sheets remain in precisely the same order as arranged; thus reducing the chances of losing any of the forms specified. In addition, the chief engineer will sign the time and cost cards, forms 5 and 16—of which there may be any number of the latter, i.e. (16), bunch them together, and secure with protecting rubber band.

The cost cards, 5 and 16, will then be forwarded to the cost department, No. 4, where a report will be made on triplicate forms 105, 106, and 107—one of each of which must be attached to the requisition for estimate, form 93 and 94, and returned with all the other data furnished, to the chief engineer, and he having assembled the whole of the completed data, forwards the same in envelope 90 to the superintendent, whose duty it is—after careful scrutiny and verification of the data entered on the respective forms—to forward originals to the engineering department, for careful filling; and complete duplicate sets on to the managing director's office, where the cost of making the estimate will be carefully noted, and from whence the duplicate will be forwarded finally to the sales division. In all their correspondence wth regard to this particular enquiry and respective job, the sales office staff must use the job number indicated on the forms; since by so doing, much confusion and trouble will be avoided—especially if the estimate is of a heterogeneous and complex character. It may be sometimes necessary to number the differentiated parts of one estimate, by giving the same, several job numbers.

The estimate being completed; having passed in systematic order through the works, and reached the sales division, it is pertinent to enquire what will be its final destiny. As already indicated, all the forms left in envelope 90, after the extraction and retention of original and triplicate, forms 105 and 107, by the cost department, and sales division respectively—having first received the authoritative approval of the superintendent, are returned to the chief engineer, who, after making sure that everything is O.K., returns envelope 90 to the estimating engineer, who retains the same in his possession until the sales division reports that the estimate has been accepted or rejected by the customer. If rejected, envelope 90 and its contents is handed to the engineering office index clerk, who straightway files it away among the records, for future reference.

In the next article we shall consider what happens when an estimate or tender is accepted.

(Continued.)

A LARGE MODERN IRON FOUNDRY

BY THE EDITOR.

Past-Foundry Engineer to the Westinghouse Machine Company, East Pittsburgh, U.S.A., and British-Westinghouse Electric and Manufacturing Co., Manchester, England.

In the autumn of 1901 the writer, having designed the equipment for the large iron and brass foundry extensions to the plant of the Westinghouse Machine Company at East Pittsburgh, U. S. A., was engaged by the British-Westinghouse Electric and Manufacturing Company to do a like service for their immense plant at Trafford Park, Manchester, England. This appointment was gratifying since the plans of the original lay-out for these famous works—covering 130 acres, and designed to accommodate over 5,000 employees—had been drawn by me in August 1899.

It is purposed to give a brief description of the English foundry, not only on account of the fame it has won, but because of some criticisms we made in our August issue when describing the Davenport foundry of the Canada Foundry Company.

Michael Angelo, the architect of St. Peter's, Rome, was observed one day drawing upon the pavement opposite a large statue. When asked what he was doing, replied, "I criticize not by finding fault but by doing something better." While it is not claimed that the "British" foundry—designed in accordance with the latest and best American practice—is perfect, yet it is rightly equipped where the Davenport foundry is defective. So much by way of preface.

The Foundry—illustrated by photo-engravings (Figs. 1 and 2) from my original drawing—is 580'-0" long x 166'-10" wide inside walls; having 80 ft. middle bay, and two side wings, 43'-5" each.

In designing the equipment the leading idea was distribution, not centralization. One had to keep in mind the very important consideration that the work to be done on the moulding floors was not to be limited to parts for electrical machinery—as at the Alleghany shops; or air brake cylinders and connected parts, as at the Wilmerding works; nor engine details, as at the Machine Company's plant East Pittsburgh—but was to embrace all the castings being made at the various Westinghouse establishments. Seeing, however, that the conditions involved in the production of electrical air brake, gas and steam engine castings are so very dissimilar in the matter of metals, cores, and appliances generally, it was found necessary to relegate the respective classes of work to clearly defined departments and sections under the one foundry roof, i. e., machine moulding of duplicate parts in the half wing on right of cupolas, medium engine and electrical work in the wing nearest the reader, while the middle bay was reserved for heavy dynamo fields, armature spiders, generator beds, etc., in the right-hand half, and larger engine cylinders, housings, bedplates, etc., at the left-hand end.

The general plan (Fig. 2), embodying the above ideas, was personally explained by the writer to Mr. George Westinghouse in September 1901, who straightway approved without alteration.

We have not space for a minute description of every part, or inventory of every appliance, but shall confine ourselves to an explanation of the special features in this foundry.

Facilities for Handling Material.

Outside the eastern side of the main building is an annex for pig iron storage, 194 ft. long by 30 ft. wide, having a strong platform level with the cupola staging. Underneath are two tracks parallel with the foundry wall, and connected by switches to the yard railway system. The outer track is used for the conveyance of pig iron and scrap supplies to the cupolas. This material is thrown out of the trucks on to the hydraulic elevator located between the pair of tracks at about the centre of the annex. When the material is elevated to the storage platform—the floor of which is covered with 3/8" steel plates—it is conveyed by roller-bearing hand trucks to certain parts, where it is stacked against the wall and tabulated according to chemical analysis. In this way a thousand tons of valuable metals can be stored conveniently for immediate use in the melting of special mixtures.

On this storage platform is installed a miniature cupola and a moulding bed for the making of test bars.

The inner track under the annex platform is used for the delivery of coke, sand, fire clay, etc. The method of conveying the coke in the cars on this track to the cupola staging above is worthy of note. On Fig.

1 is shown a box car standing on the track, and between this car and the foundry wall is indicated a motor-driven bucket conveyor, into which the coke is shovelled by one laborer and conveyed by the buckets up over a sprocket wheel, near the wing roof, and dropped down on to the staging, ready for use in the cupolas. The good points of this simple and economical device for handling coke for foundry cupolas must be manifest even to the uninitiated in modern foundry practice.

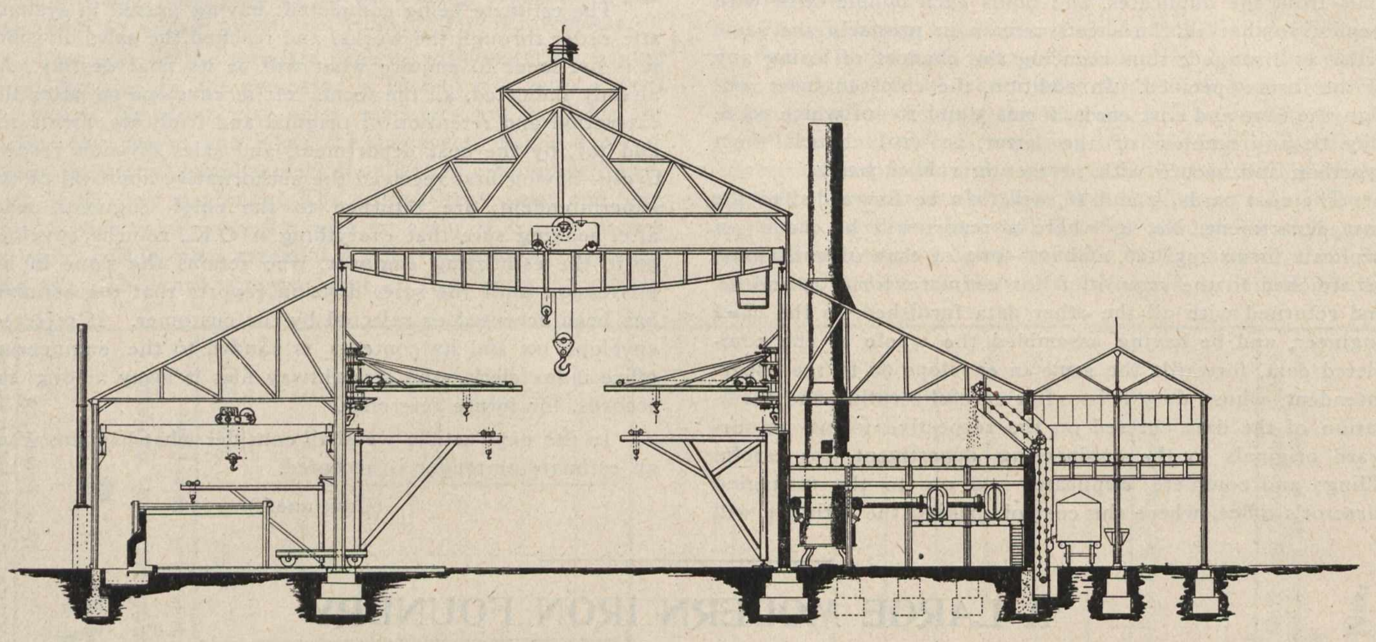
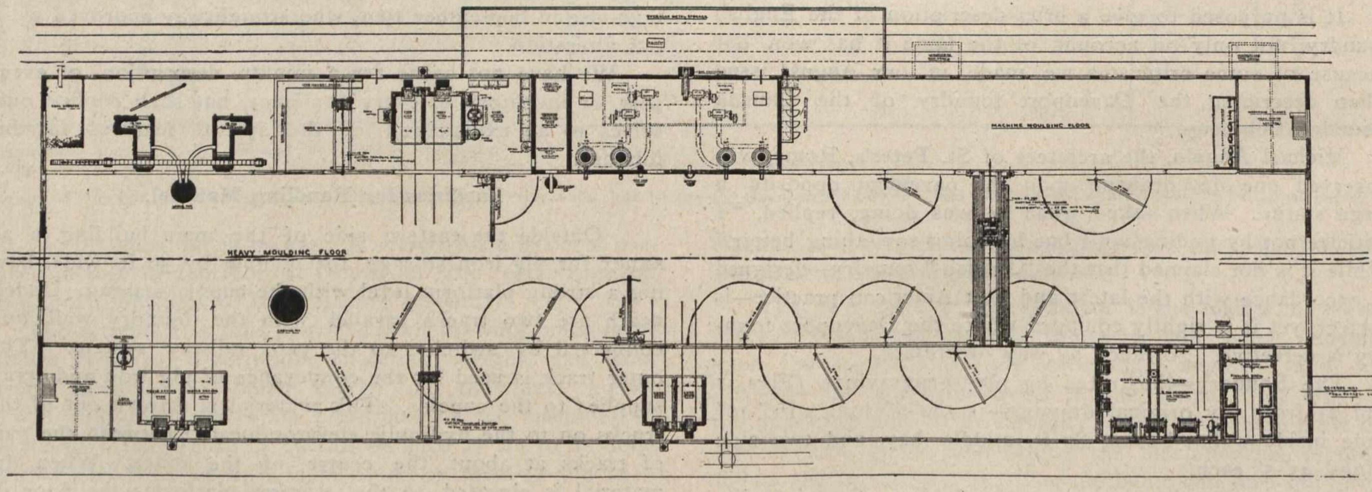


Fig. 1.—Section Through Cupola House.

Core Ovens.

It is common in many foundries to group the core ovens together: and when a shop is run on specialties, and the range in weight and form not very diverse, the scheme works well. But where the castings range in weight from 50 tons down to a few pounds, and the methods of moulding embrace practically all the lines in the art of founding, green sand, dry sand and loam, and these respective operations are performed in clearly defined areas—in some cases 500 feet apart—and the cores required are almost as varied in size, shape, and composition as there are castings, then centralization of the core ovens is anything but an economical arrangement. The reasons are obvious. In the first place the materials required for green sand, dry sand, and loam cores are so entirely different, and the means for manipulating the same so varied that the mixed coremakers are constantly getting into each other's way, working at cross purposes, and causing delays and trouble in all parts of the foundry. Moreover, the continual conveyance of heavy cores, 250 ft. down the shop, is a dangerous procedure, and causes serious cumulative loss of time, since the men at work in the moulds have to get up and out of the way whenever a core comes swinging down the bay. Besides the tying up of the heavy cranes at one end of the shop and consequent standstill of moulders at the other is a prolific cause of profanity on the part of the men, to say nothing of monetary loss on the part of the master. These important considerations were all taken into account when cogitating upon the best location for the core ovens. The distributive plan was decided upon. Pairs of core ovens were placed in different parts of the foundry in close proximity to special lines of work, thus avoiding nearly all the objectionable drawbacks and hindrances which centralization would have caused. Two ovens 18'-0" wide were placed in the north-west corner for receiving lofty cylinder-crosshead-guide cores, and whole dry sand cylinder moulds, weighing over 20 tons, etc.; two 12'-6" wide were built in the middle of the left half of the eastern wing, for medium cores to be used down the central bay; and another pair 16'-4" and 12'-6" wide respectively; for gas engine castings, etc., were located midway in the western wing. The small cores for machine moulding department were provided for in a series of small ovens of the "Millett" type, fixed in the northern end of the right-hand half of the eastern wing, next the cupola house. It will be perceived, upon examining Fig. 2, that although all the ovens are located in the wings

EAST.



WEST.

Fig. 2.—General Plan of British-Westinghouse Iron Foundry.

they are not obstructive, since a 12'-0" space was left between the doors and the large columns of the central bay. By this provision cores, castings, etc., could be conveyed from one end of the wing to the other without having to pass over the top of the ovens. A special feature of these core ovens is, that instead of the old-fashioned lifting doors, with chains and weights, they are all provided with steel rolling doors, operated by easily worked gear mechanism and hand chains. So entirely satisfactory were these doors that the Westinghouse Machine Company have since fitted up, in like manner, all their new foundry core ovens at Trafford City, near Pittsburgh. Not only was the introduction of this type of door an innovation in Britain but also the hollow-wood bricks of which the arched roofs were constructed. These bricks, made of terra cotta and sawdust, into which nails can be driven as easily as into wood, have now become standard for core oven roofs.

Travelling Jib Cranes.

In Figs. 1 and 2 are shown a pair of travelling jib cranes; an altogether admirable appliance in foundries of magnitude. Although approved, these cranes were not installed at Manchester, owing to the fact that the money appropriation had become exhausted by extravagant expenditure in other and less important departments. It is true the first cost of the necessary runways, and the cranes also, is an expensive item; for in 1901 a three ton electric travelling jib crane cost $2,500; but those who have had them once in use would not willingly be without them. When the heavy overhead travellers are tied up with, say, a heavy core or mould, and the fixed jib cranes nearby engaged, these cranes can sail down the shop at 100 ft. per minute with valuable loads. If ever there was a time and money-saver in a foundry this type of crane is one. It is not surprising, therefore, that four have been installed at the new Trafford City "Westinghouse" foundry.

Machine Moulding.

One of the most interesting departments is that devoted to machine moulding, located in the southern half of the eastern wing. This part is a veritable bee-hive. Down the centre are two rows of cast iron columns, each pair surmounted by an 8" steel I beam. On these beams are secured a double line of "Colburn" trolley tracks, capable of sustaining a load of 6,000 lbs. These parallel tracks have enlarged loops at each end, and switches for cross-transfer from one line to the other. The loop at northern end projects over the spout of the 60" cupola, so that metal ladles hung from the overhead trolley receive the molten metal from the cupola, and are pushed along quickly, yet smoothly, to the various batches of moulds—made on the machines—where it is received in hand ladles by the moulders. This process of circularity enables the founders to pour off their moulds in quick order. The loop at southern end environs a series of exhaust rumblers—an arrangement of manifest utility; for after the moulds are shaken out, the laborers detach the ladles from the trolley hangers, and attach in place thereof a series of steel scuttles, into which the castings are thrown, and pushed along with ease to the rumblers.

There are many other interesting points about this immense jobbing foundry worth describing; such as the "Sturtevant" fans, and unique system of conveying blast from same to the cupolas; the cast iron lining in cupolas; the machines and appliances for mixing facings; the pickling vats for dissolving core sands in cylinder parts, etc., but owing to limited space must reserve these notes for some future occasion.

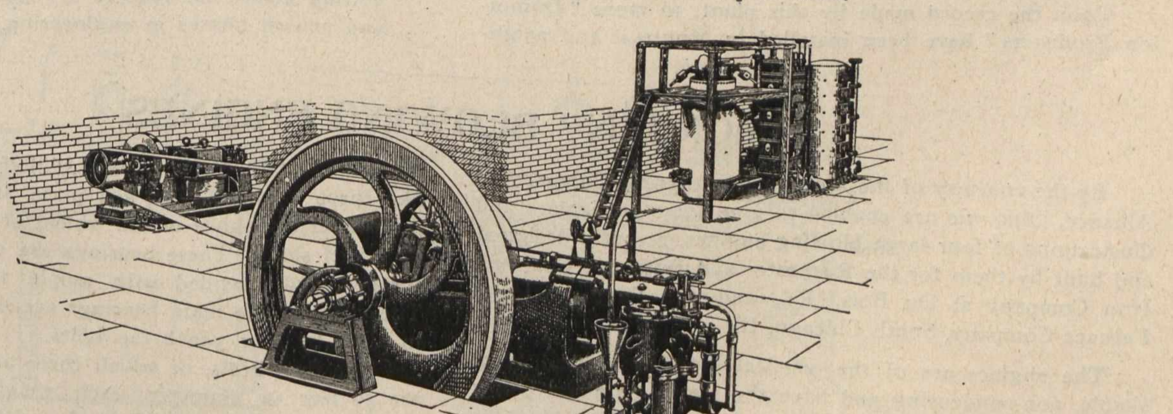
SUCTION GAS PRODUCERS AND GAS ENGINE PLANTS IN THE PROVINCE OF QUEBEC

BY J. DE CLERCY, C.E., OF MONTREAL.

So far, the establishment of gas plants for power in the United States has not been wide spread, because the average power required for manufacturing purposes in that country is over 300 horse-power.

But, in Europe, where small manufacturers are very numerous, motors with gas producers are gradually taking the place of steam plants for the following reasons:—

Raising steam in a boiler takes from 30 to 60 minutes, and the great quantity of coal used for this purpose is practically lost, no matter how long may be the running of the engine.



The average consumption of coal in a steam engine from 10 to 30 horse-power is from 4 to 8 lbs. per effective horse-power per hour, including coal starting; while the consumption of the best steam engine of 100 to 500 horse-power, is not less than 2 lbs. per brake horse-power per hour. This consumption depends largely upon the stoker, the quality of coal used and the coating of scale in the boiler tubes or flues.

In the smallest steam plants the wages of the attendant are out of proportion to the work done by the engine, since a skilled fireman is always necessary to watch over a steam boiler.

In a steam boiler an explosion is always possible, and more so in smaller plants, since these are often attended to by second-rate men, and operated with low water.

With small boilers the repair bill is always high, and repairs are often difficult. Sometimes small boilers ought to be replaced after four or five years' service, because it is not worth while to repair them.

On the other hand, it is evident that a gas plant and gas engine are not subject to these drawbacks. In the smallest of these plants, the efficiency reaches easily 80 per cent., and the consumption of fuel at starting is practically nil: not even 4 or 5 lbs. of coal. In the operation of small plants the consumption of coal is about 1 lb. per hour per horse-power; and about 0.8 of a lb. in plants of more than 60 horse-power. In producer gas plants the coal feed is automatic, hence the results are always the same, and very little attendance is required. The absence of a stoker reduces the wage account by $1.00 to $1.50 per day. In small plants an attendance of 1½ hours per day, by any ordinary hand, is all that is required, thus enabling the attendant to do other work about the factory.

Again, explosions are not to be feared, as the whole plant contains only a very small quantity of gas. In fact, there is no more risk than with a large stove. An important leakage in a suction gas plant would have no other result than the introduction of a large proportion of air into the gas, which would stop the engine. A gas plant of this description can be erected anywhere without any risk, the cost of insurance being much less than for steam boilers, and the surrounding air is free from smoke or unpleasant smell. This is a powerful argument in residence localities, where complaints from civil authorities or neighbors might be expected.

In gas plants the quantity of water is small and the quality of no importance. In places where water is acid or scarce, this is a factor worthy of consideration.

In a well designed and constructed gas generating and power plant repairs are rare and of very small importance.

Briefly, the advantages of gas power over steam power are:—

1. Great economy of fuel.
2. Economy of water.
3. Economy of attendance.
4. Economy of wear and tear.
5. Economy of insurance rates.
6. No noise, smoke, or dust; no danger, and no expense when the engine is not running.

In Canada, where manufacturing is on a smaller scale than in the United States, gas power plants are destined to become popular.

A producer running by suction of the engine was specially constructed in the shops of Messrs. Farand and Delorme, boilermakers, Montreal, to run on the cheapest quality of anthracite which could be found in this city; a small pea-anthracite coal containing a large proportion of stones and ashes.

Most of the European producers would not work at all on such a coal. This apparatus was named "Dominion Producer." The first "Dominion Producer" laid down in Canada was installed in February 1904, at the factory of Messrs. Dufresne et Locke, shoe manufacturers, of Maisonneuve, near Montreal. This installation has been running for the past nineteen months, and has given entire satisfaction. The required power is 20 horse-power, and the expense of fuel for every 60 hours of weekly work is $3.50, say about 259 lbs. of coal per day.

Upon the record made by this plant, 10 more "Dominion Producers" have been installed in Montreal and neighborhood, and two in the United States. The following list will interest Canadian manufacturers:—

An 18 horse-power gas plant at Hon. Geo. G. Drummond's farm, Beaconsfield, P.Q., for farm work and electric lighting.

A 20 horse-power gas plant at the Mount St. Louis College, Montreal, for electric lighting.

A 32 horse-power gas plant at Messrs. Sylvester Bros.' mill, Clairvaux, P.Q. The trials on the latter plant have shown that 150 horse-power was obtained by the burning of 183 lbs. of coal, including lighting, stoppages, etc.

A 35 horse-power gas plant at the Montreal Terra Cotta Lumber Company, at Maisonneuve, P.Q. This plant has demonstrated the reliability of suction gas power plants; since it is working 24 hours a day, from Monday morning to Sunday morning without any stoppage; the coal consumption being 3½ tons every two weeks.

Two 27 horse-power gas plants at the Kingsbury Footwear Company, Maisonneuve, one for driving the factory, the other for driving a dynamo.

Thus the cities of Montreal and Maisonneuve are already in advance of any other city of Canada or the United States in the use of "Producer Gas Power Plants."

The "Dominion Producer" is designed to burn American pea-anthracite coal of ordinary quality; but producers operated by other fuel are in operation in the Province of Quebec; for example, the sawmill of Mr. Roux, Ste. Thérèse, P.Q., is driven by a 60 horse-power Stockport gas engine running on sawdust. Three pounds of wood or sawdust generate 1 horse-power per hour.

Producer gas can be made from wood, sawdust, lignite, raw peat and every kind of coal, and the lower the quality of the fuel the larger is the economy of transforming it into gas for power by means of a gas engine; instead of burning it in a grate under a boiler.

1 E. H. P. may be developed from 3 lbs. of wood.
1 " " " " " 2½ lbs. of raw peat.
1 " " " " " 3½ lbs. of sawdust, etc.

Low fuels are very plentiful in Canada and their use as motive power by gas engines would be, in many cases, a large economy to be compared only with water power.

This brief and very inadequate statement of the rapid development of producer gas power plants in the Province of Quebec will, it is hoped, help to draw attention to a phase of engineering which, for the reasons set forth, are destined to play an important part in the future industrial development of Canada.

[We do not hold ourselves responsible for the views expressed, or statements made in the foregoing article. We are simply an out-look committee, setting before our readers the latest technical ideas, and newest phases in engineering.—Editor.]

"MORGAN" BLOWING ENGINES

By the courtesy of the Morgan Engineering Company of Alliance, Ohio, we are enabled to give some particulars and illustrations of four large blowing engines, recently designed and built by them for the Rochester and Pittsburg Coal and Iron Company at Du Bois, Pa., and the South Chicago Furnace Company, South Chicago, Ill.

The engines are of the vertical long cross-head type, simple, non-condensing and have the steam cylinders below the cross-head and the air cylinders above. The diameter of the steam cylinders of all these engines is 44 inches, while the air cylinders are 84 inches in diameter. The stroke of the engine is 60 inches. Thus at 42 revolutions per minute each machine will deliver about 16,000 cubic feet of free air per minute, at 25 lbs. above atmospheric pressure. These engines were constructed under the most rigid specifications as to workmanship and material, and at the present time seem to be giving the best of satisfaction.

The main bed plate rests directly upon the foundation, and is cast in one piece from the best quality of iron. This bed plate is of very massive form, strongly ribbed, and in every way suitable for rigidly supporting a heavy machine like these engines. The bed plate is cored to receive a thick layer of babbitt metal, which forms the bearings of the fly wheel shaft. These bearings are carefully bored to size, scraped, and provided with ample means for lubrication. The caps for the main bearings are strongly made and held in place by four 3-inch tap bolts.

The fly wheels, of which there are two to each engine, are 20 feet in diameter, each weighing about 50,000 lbs. They are well counterbalanced and calculated to run at a speed much in excess of that to which they are subject under the hardest service. The central hub of each fly wheel is of cast iron and strongly keyed to shaft. These hubs form crank discs into which the crank pins are forced and riveted. The rim of the wheel is made in halves and securely fitted to the disc. In the rim it will be noticed there are recesses to allow for barring the wheel.

The crank pins, which are 10 inches in diameter, are made of the very best grade of steel forgings of about .40 per cent. carbon, and as stated above are forced into crank discs and riveted thereto.

The main shaft is 20 inches in diameter. It is also of the best quality of forged steel and is ground true on dead centres.

The connecting rods, of which there are two to each engine, are of open hearth forged steel, .25 to .30 per cent. carbon. These rods are of the solid end type, provided with the necessary brass boxes, babbitt lining, adjusting wedge, etc., arranged to take any wear in the bearing.

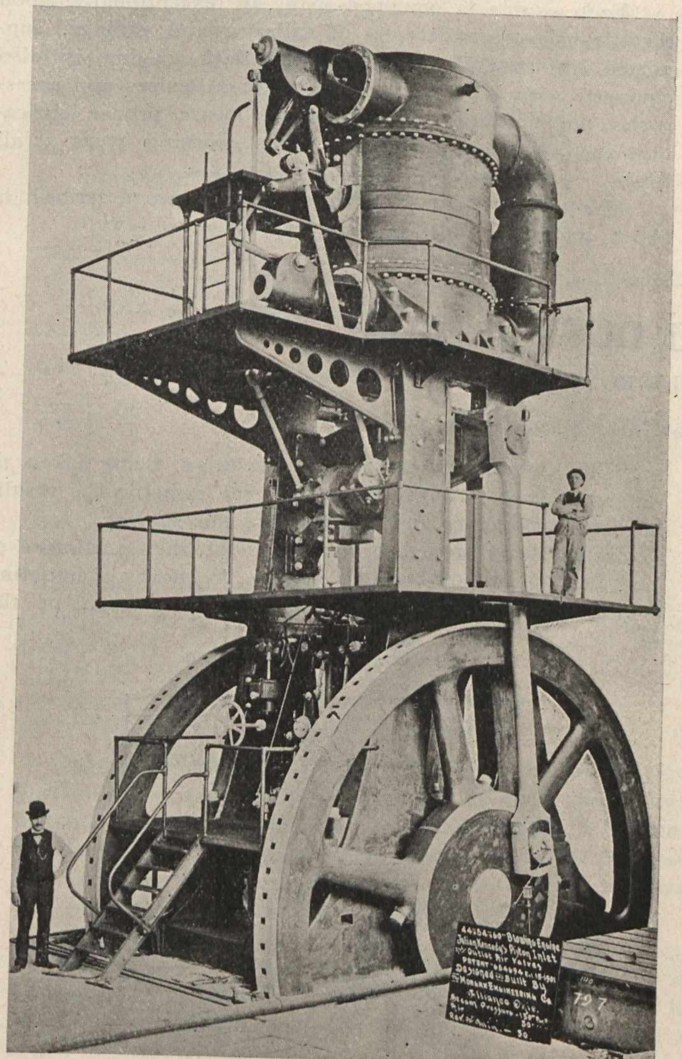


Fig. 1.—Morgan Blowing Engine.

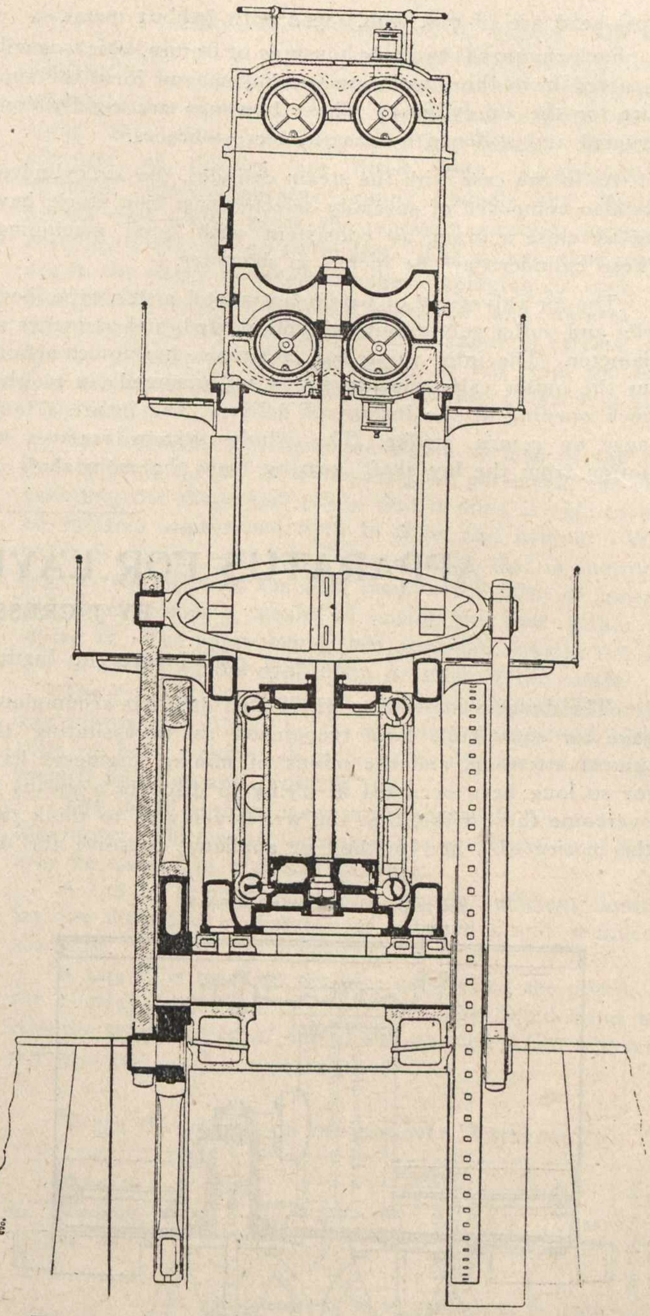


Fig. 2.—Vertical Section Through Blowing Engine.

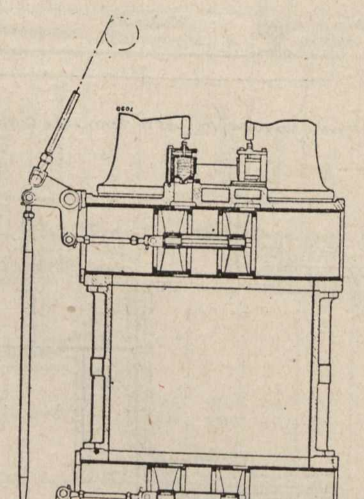


Fig. 3.—Section Through Air-Discharge Valves.

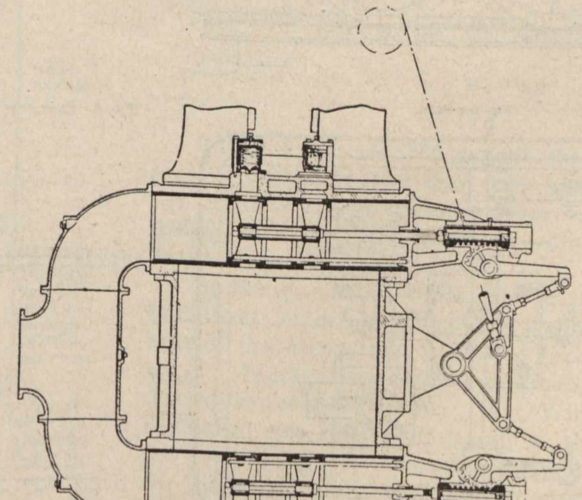


Fig. 4.—Section Through Air-Inlet Valves.

The steam cylinders, which are 44 inches in diameter, are made of specially selected cast iron stock, and each contains four valve chambers for the valves, which are of the Corliss type. The exhaust chamber is cast separate from cylinders, thus reducing internal condensation. The steam cylinders are lagged with non-condensing covering and furnished with sheet steel jacket with corner angles. A relief valve is located in each end of each cylinder.

The crosshead is a steel casting carefully annealed and ends turned to form the crosshead pins. The shoes of the cross-head are of cast iron, faced with babbitt metal.

Each engine has two side housings or frames, which, as will be noted from the illustration, extend up and form the support for the air cylinder. These housings are rigidly constructed and stiffened by cast iron cross-braces.

As in the case with the steam cylinder, the air cylinders are also composed of specially selected cast iron stock, having as close a grain as consistent with good machining. These cylinders are 84 inches in diameter.

The air valves are of patent horizontal piston type, both inlet and outlet valves being double ported, and 24 inches in diameter. The inlet valve has a simple harmonic action, but the outlet valve mechanism is so arranged as to give quick opening at the instant of delivery, and insure a long pause on return stroke. The whole system receives its motion from the lay shaft, gearing from the main shaft of the engine. Great care was used in designing these valves and connections, that they might be sufficiently strong and yet not contain weight detrimental to their proper operation.

As stated, the steam cylinders are fitted with standard Corliss type valve gearing, operated through single eccentric and wrist plate. The governor is of the ball type driven positively by gearing, with speeeding device to govern the engine through a considerable range without stopping it.

Each engine is equipped with an exceptionally good throttle valve, complete set of galleries and railings, supported by tasteful iron brackets. Each engine is also equipped with a complete set of oiling devices and accessories, and nothing is left undone to insure proper lubrication and adjustment of the various working parts at all times.

The total weight of each of the engines described is about 400,000 pounds.

APPARATUS FOR LAYING DUST IN COAL MINES

BY J. CRESSWELL-ROSCAMP.

A paper read before the Institute of Mining Engineers, England.

The dangers impending where coal dust has accumulated have for some time been recognized as necessitating the utmost attention, and the minds of mining engineers have for so long been occupied in trying to discover a means to overcome these risks, that the writer ventures to think that this notice of a new method or appliance to solve the difficulty needs no apology, but will be received with approval by the members.

In submitting the following short paper, it is his desire to place on record the information which has been gathered from some satisfactory personal experiments. Experiments, conducted both in this country and abroad, all tend to prove the vital importance of every precaution being taken to render impossible any repetition of the catastrophes resulting from negligence and ignorance of this subject.

It has been proved beyond a doubt that a mixture of coal dust and atmospheric air may be the means of initiating a violent and destructive colliery-explosion, even in the absence of fire-damp, and, the finer the dust, the more easily will it ignite and become dangerous.

Prof. W. Galloway has said that very little dampness is necessary to prevent coal dust from igniting, and he has given many instances of explosion in which the flame has stopped when it has come to a part of the road that was

FIG. 1.—SECTION ON LINE AB OF FIG. 3.

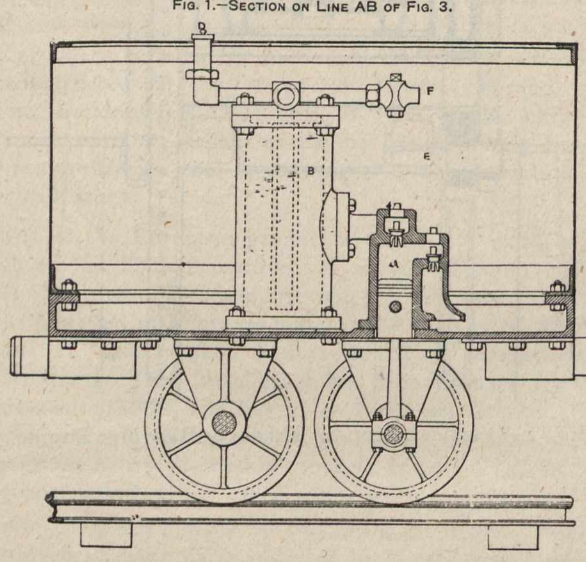


FIG. 2.—SECTION ON LINE CD OF FIG. 3.

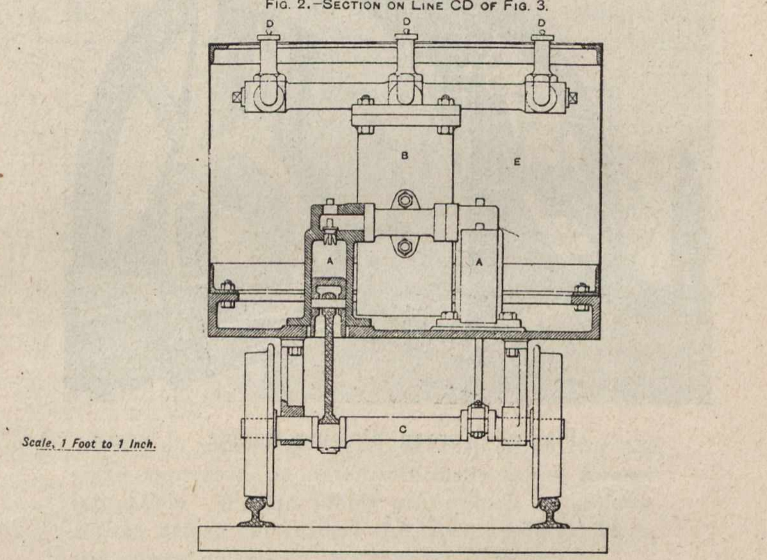


FIG. 3.—PLAN.

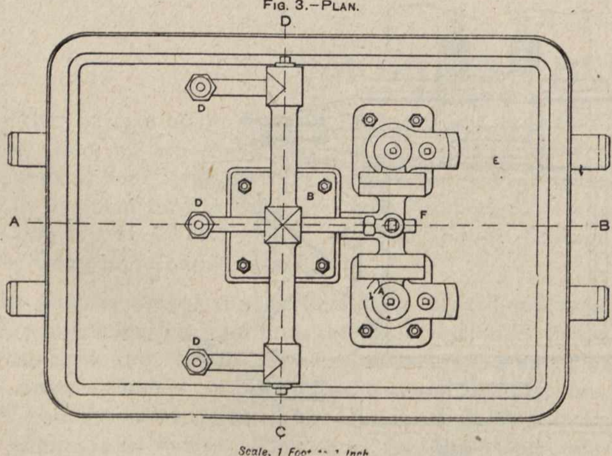
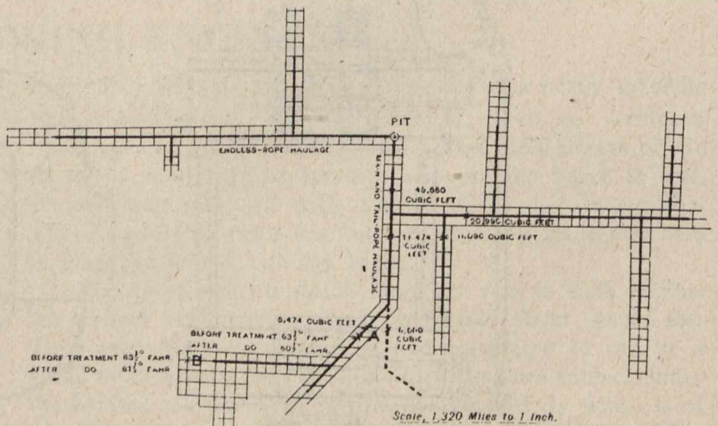


FIG 4.—PLAN SHEWING HAULAGE-ROADS AND VOLUMES OF VENTILATING CURRENTS, ETC. IN A COLLIERY



An Improved Apparatus for Laying Dust in Coal Mines.

only damp, and not wet, as advocated as a necessity by many.

Up to the present time, it appears to be the general opinion that water is the most potent agent in obviating these dangers, and any method by which this element may reach the various parts of the roadway, such as the roof, timbers and vertical surfaces, in order to dampen the dust effectually and thus render it harmless, will naturally commend itself to all unprejudiced minds; and, moreover, in the application of this liquid the nearer it approaches the condition of aqueous vapor, the greater will be its power, and the more complete its success.

Table I.—Thermometer Readings before and after the Passage of the Improved Watering Tub.

Time.	Thermometer. At Bank.	Thermometer. Underground.	Barometer. At Bank.	Barometer. Underground.	Dry-bulb Thermometer.	Wet-bulb Thermometer.	Humidity.	Remarks.
a. m.	Degs. Fahr.	Degs. Fahr.	Inches.	Inches.	Degs. Fahr.	Degs. Fahr.	Percentage	
11.30	53½	64	29.99	30.67	61	58½	83.4	Raining.
11.45	—	—	—	—	60¾	59¼	89.2	Tub passed the hygrometer at 11.35 a.m.
12.0	—	—	—	—	60¾	59	88.1	
12.15	—	—	—	—	61	58¾	85.4	
12.30	57	66	30.06	30.72	61	58½	83.4	Dry and warm.
11.30	59	68	29.83	30.46	64½	62	82.4	Dry and warm.
11.45	—	—	—	—	64	62¾	91.2	Tub passed the hygrometer at 11.35 a. m.
12.0	—	—	—	—	64¼	63	90.5	
12.15	—	—	—	—	64¼	63	89.8	
12.30	—	—	—	—	64½	62¾	87.3	
12.45	—	—	—	—	64½	62¼	84.9	
1.0	64	69	29.80	30.44	64½	62	82.4	

Many attempts have been made to water and lay the dust on the roads, sides, and timbers in coal mines, and methods have even been introduced and brought before the members claiming to prevent the accumulation of the dust. However, no apparatus, hitherto devised for this purpose, has been entirely satisfactory in efficiency and practice.

One method, by which this has been effected, is an improved watering tub,* which, in outward appearance, is similar to an ordinary colliery tub. The mechanism is simple, consisting of two small pumps, A, with cylinders 3 inches in diameter by 2 inches stroke, and an air-cylinder, B, 7 inches in diameter and 14 inches high. The pumps are driven direct from one axle, C, of the tub, and connected to three sprayers or nozzles, D, fitted so that either one or all may be used. In this simplicity of construction there are several advantages, as no packing is required, there is no gearing to get out of order, and, in fact, the whole contrivance is readily handled and easy of access. The action is as follows:—The water (or other liquid carried in the tub, E) is forced by the pumps, A, into the air-cylinder, B, which causes a regular and unpulsating column to flow along the pipes and out of the nozzles D. These sprayers or nozzles are fitted with a specially-constructed screw-apparatus round which the liquid is forced, and which gives the spray a circular momentum reaching a breadth up to 30 feet. The sprays, thus emitted, are in the shape of inverted cones impinging on each other and becoming so completely atomized and aerated, that they in reality form a vapor. This vapor is carried along by the air-current, and can clearly be felt from 100 to 150 feet behind the tub, when it is in motion (Figs. 1, 2 and 3, Plate XX.).

Table II.—Thermometer Readings before and after the Passage of the Improved Watering Tub (Fig. 4, Plate XX.)

Time.	Thermometer. At Bank.	Thermometer. Underground.	Barometer. At Bank.	Barometer. Underground.	Thermometer in Haulage-road, A. Before.	Thermometer in Haulage-road, A. After.	Thermometer in Haulage-road, A. Difference.	Thermometer at Coal-face, B. Before.	Thermometer at Coal-face, B. After.	Thermometer at Coal-face, B. Difference.	Remarks.
a. m.	Degs. Fahr.	Degs. Fahr.	Ins.	Ins.	Degs. Fahr.	Degs. Fahr.	Degs. Fahr.	Degs. Fahr.	Degs. Fahr.	Degs. Fahr.	
11.0	56½	66½	29.40	30.56	63½	—	—	63½	—	—	Raining.
11.30	—	—	—	—	—	60½	- 3	—	61½	- 2	Tub passed the ther. in haulage-road at 11.10 a m
12.0	—	—	—	—	—	61½	+1	—	61	- ½	
12.30	60	67¼	29.38	30.56	—	62½	+1	—	61	- 0	Vol. of air at f'ce 1400 cub. ft. per m.

In this way, therefore, the whole surface of the roadway is damped, and as will readily be perceived, the spray, assuming the shape and nature that it does, is able to damp all surfaces approached both in front and behind. Where water is applied with any force on dust that is thoroughly dry, it runs off with the finer dust in the form of spherules and then bcomes a means of raising the dust rather than laying it. The spray being thus atomized, should not have any ill-effects on the roof, floor, or sides of the roads.

The tub will travel and do its work quite as efficiently by any means of haulage, be the system main-and-tail, endless rope or horse; and it is quite as easily moved along by manual labor as any ordinary tub.

The liquid sprayed need not necessarily be water, and lime-water, white-wash, or any other preservative of timber may be ejected in a similar manner.

A tub of ordinary size will contain sufficient liquid to lay the dust over a distance of between 1 and 2 miles of roadway.

A tap, F, is fitted to the pipe connecting the pumps and the nozzles, and when this is turned, the liquid flows back into the tank instead of out of the nozzles, when a spray is not desired.

Table III.—Trials of the Improved Watering Tub.

No.	Description	Distance	Time	Speed per Hour	Roadway: Perimeter	Roadway: Surface	Roadway: Calculated Surface of Timber, etc.	Roadway: Total Surface	Wat'r Used	Surface wetted per Gallon of Water used
		Ft.	Min	Miles	Ft.	Sq. Ft.	Sq. Ft.	Sq. Ft.	Galls.	Sq. Ft.
1	Tub drawn by main-and-tail-rope - - - -	2,970	3¾	9	35	103.950	31,200	135,150	60.87	2,220
2	Tub drawn by horse - - -	1,854	8½	2.49	35	64,890	16,656	81,546	44.27	1,842
3	Tub drawn by endless rope -	4,800	13⅔	4	34	163,200	74,400	237,600	110.27	2,154

Tables I., II. and III. contain the results of a few personal experiments, and they fully justify the assertion that the imminently dangerous properties of coal dust are minimized to an infinitesimal quantity by the treatment herein described.

In the discussion which followed, Mr. G. H. Coates (England) an eye witness, bore testimony to the effectiveness of the device, and suggested that in place of water, a liquid disinfectant should be used, and thus prevent "Ankylostomiasis." Mr. F. Winkhaus (Altenessen, Germany) also referred favorably to the apparatus, deeming the device of special interest, inasmuch as it turned to profit the action of compressed air in producing a good dust-dispersal, with a minimum waste of water.

Note.—The adoption of apparatus similar to that described in the foregoing paper, would in all probability have prevented the sad disaster which occurred in the coal mine of the Crow's Nest Pass Coal Company, British Columbia, November 18th, 1904; when four Englishmen, and ten foreigners lost their lives. (Editor.)

* British patent, 1903, No. 9,268, Messrs. F. Herbert and P. Kirkup.

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The Canada Foundry Co., Limited, Davenport, is soon to commence the erection of a large pipe foundry, for the manufacture of all kinds of cast-iron pipes.

"ALLOYS."

BY PERCY LONGMUIR, OF LONDON, ENGLAND.

Carnegie Research Medallist.

(All rights reserved.)

(Continued.)

Ordinary Brasses.

The term brass, as used in practice, applies to those alloys in which copper and zinc are the essential constituents. In composition brasses range from 90 to 35 per cent. copper and from 10 to 65 per cent. zinc. Between these proportions a range of color from coppery red to light yellow is found. Quite apart from color, ranges of mechanical properties and of cost of production are also offered. Thus the higher the copper content of the alloy the greater its cost. The following tests by the writer illustrate the range in mechanical properties:—

	Analyses			Mechanical Properties		
	Copper	Zinc.	Specific Gravity	Max. Stress Tons per sq. inch	Elongation % on 2 inches	Reduction of area %
Copper as cast..	....	....	8.80	9.0	11.0	....
Zinc as cast	....	....	7.30	1.5	....	....
Red Brass	89.6	10.2	8.55	12.6	26.0	30.0
Yellow Brass ...	73.0	26.0	8.10	13.0	43.0	35.0
Muntz Metal ...	59.0	40.0	8.03	19.0	15.0	16.0

The foregoing tests each represent the mean of several determinations from bars in the condition "as cost," i.e., untreated. Annealing, rolling, drawing, or other treatment has a corresponding effect on the mechanical properties. The industrial value of alloying is shown in a comparison of the results obtained from metallic copper and zinc with those of the three following brasses: The brittle metal zinc, which alone has a tenacity of 1½ tons per square inch, yields, when added to copper to the extent of 40 per cent., an alloy extremely tenacious, and at the same time one possessing a fair degree of ductility. It will be noted that from 26 to 40 per cent. zinc, an increase in maximum stress is associated with a distinct fall in extensibility. Exceeding 40 per cent. zinc tenacity and ductility fall together. Common casting brasses may contain up to 50 per cent. zinc, which results in an alloy possessing a decidedly light or pale yellow color. As the content of zinc increases beyond 50 per cent. decisive brittleness is evidenced, and with each increment the yellow tint is replaced by grey or white.

The following compositions show the variations found in actual practice:—

	Ormolu or Red Metal.	Brazing Metal.	Sheet or Wire Brass.	English Standard Brass.	Muntz Metal.
Copper %	90	90 to 80	64 to 74	70	60
Zinc %	10	10 to 20	36 to 26	30	40

Ormolu is largely employed for artistic castings, which after buffing or burnishing yield a rich copper red color. A typical brass yellow color is obtained from the English standard, whilst a lighter yellow is obtained from the Muntz alloy. From an ornamental point of view these colors are of some importance, thus in composite figures good contrasts are obtained by having certain portions in red and others in yellow brass. Red brass is often used in conjunction with wrought iron, a common example being found in the case of fire irons, the heads of which are cast from red metal, and the shanks formed of black wrought iron. A steam gauge case may have the full yellow of the outside casing relieved by a light inner ring of red metal. Lavatory and bath fittings offer further illustrations of the utilization of different colors obtained by varying the composition of different parts.

Hard solders form an important class of copper zinc alloys. In composition these solders vary from 60 to 34 per cent. copper, and zinc from 40 to 66 per cent. zinc. They are employed for hard soldering or "brazing," and when used for copper or brass articles the composition is so arranged as to give a lower melting point than that of the articles to be brazed. The higher the content of zinc in the solder the lower its melting point, hence for copper articles a solder approaching 60 per cent. copper and 40 per cent. zinc is employed, whilst for yellow brass articles one of 34 per cent copper and 66 per cent. zinc is usual. Brazing solders are granulated by pouring through a sieve into water, and a fall of 10 feet will give fairly uniform shot.

Special Brasses.

Under this heading are included alloys in which copper and zinc are the essential constituents, but the properties of the alloys are modified by the presence of a third element. Of these special elements the most noteworthy are lead, iron, tin, manganese, and aluminium. Lead added to a brass makes it, in technical language, "machine sweeter," and incidentally it lessens the cost of production. With an ordinary yellow metal a limit is found in a content of 6 per cent., and even with this amount, if the castings are heavy, the lead will tend to liquate, i.e., during cooling lead will collect in the heavier portions of the casting, or if of equal section it will gather at the bottom of the casting. A practical wrinkle, well worth knowing, is that a trace of antimony added to a yellow brass will enable it to "carry" lead with less fear of liquation. All castings having to undergo the process of dipping,* should be free from lead, for if present this metal will leave dark stains on an otherwise bright surface. Iron, tin, manganese, or aluminium when present in brasses † are usually in small quantities only. The following table embraces various industrial types of special brasses:—

	Common Casting Brass	Sterro Metal	Naval Brass	Aluminium Brass 1	Aluminium Brass 2	Manganese Brass 1	Manganese Brass 2	Manganese Brass 3
Copper % ..	60	60	61	63	60	60	60	53
Zinc %	34	38	38	37	39	38	38	42
Iron %	..	2	..	..	..	1.5	1.0	....
Lead %	6	..	..	..	..	..	..	....
Aluminium % ..	..	..	..	3	1	..	..	1.2
Manganese % ..	..	..	..	..	..	0.5	1.0	3.8
Tin %	..	..	1	..	..	..	..	..

The casting brass represents a cheaper type than the English standard already given, it is used for all ordinary castings, ship side lights, deck fittings, and so forth, but not for ornamental castings in which a full yellow color is desirable. Sterro metal gives an alloy of high strength, but the iron must be alloyed with the copper and zinc, and not present as mechanically free iron. Castings of naval brass are largely used in marine work, chiefly in positions exposed to the action of salt or bilge water. Aluminium brasses possess high tenacities, but these alloys are not largely used. Brasses containing manganese are familiarly known as manganese bronzes. A peculiarity of these alloys is found in the low content of manganese, and the author has examined many samples containing mere traces only. It is also worthy of note that in many commercial samples the content of iron often exceeds that of manganese, a feature which points to the use of ferro manganese as a source of manganese, and also to the fact that this metal is oxidised, whilst iron remains. In spite of the fact that no manganese may be present in the cold alloy it has nevertheless served its purpose in removing oxygen from the fluid alloy, and therein lies one of the chief applications of manganese in metallurgy. From the three compositions of manganese

* Immersion in *aqua fortis.*

† *Brasses,* not bronzes.

bronze given it will be noted that they are essentially yellow metals, i.e., high zinc alloys. The tensile tests already given show that an alloy containing 26 per cent. zinc yields a maximum stress of 13 tons and an elongation of 43 per cent., whilst an alloy containing 40 per cent. zinc gives a stress of 19 tons and elongation of 15 per cent. A typical result for manganese bronze, cast under the best conditions, is found in a maximum stress of 28 tons per square inch, with an elongation of 26 per cent. on two inches, a value considerably in advance of the copper zinc alloys. This high value is due to a complexity of causes and as in addition to manganese, iron and aluminium are often present it may be well to examine the individual influence of these elements, taking as a base the 40 per cent. zinc-copper alloy already given. If to this alloy 1½ per cent. of iron is added, zinc being reduced accordingly, the maximum stress will be increased from 19 to about 23 tons per square inch, with an approximately similar elongation. The effect of aluminium on high zinc alloys is erratic, however, ignoring these variations as far as possible, an average result obtained by adding 0.5 per cent. aluminium to an alloy of 60 per cent. copper and 39.5 per cent. zinc would be as follows:—

Maximum stress tons per square inch,	Elongation per cent. on 2″
20.	22 to 25.

An alloy of 1.5 per cent. manganese, 60 per cent. copper, and 38.5 per cent. zinc would yield:—

Maximum stress tons per square inch,	Elongation per cent.,
20 to 24.	25 to 30.

Evidently then iron, aluminium, and manganese, when individually present in amounts not exceeding those specified, increase the mechanical properties of the alloys. That this increase is maintained and augmented when the three metals are collectively present is shown in the tests given. Even though the content of manganese may be low, it has by reducing oxides and removing oxygen most effectually done its work, by placing the alloy in such a condition as to yield its best properties. A practical feature of much value lies in the fact that the content of zinc must not fall below 35 per cent. in manganese bronzes for castings. A reason for this is found in the influence of zinc on the mechanical properties of copper, and in the fact that the base of these bronzes is essentially a 60-40 alloy. The additions are made solely to increase the original properties of the base.

Before leaving special brasses it may be well to refer to some recent work in this direction by M. Guillet, who has examined the effect of lead, tin, manganese, and aluminium on copper zinc alloys.* The influence of lead is shown in the following table:—

Analyses.			Mechanical Properties.	
Copper.	Zinc by difference.	Lead.	Maximum stress, Tons per sq. in.	Elongation %
60.0	40.0	0.0	20.25	47.0
59.5	40.0	0.5	20.40	33.5
59.0	39.8	1.2	17.75	14.9
60.1	37.2	2.1	19.20	12.5
53.9	39.1	3.0	18.55	12.5
70.4	29.6	0.0	12.70	68
69.1	30.2	0.7	10.40	42
67.9	30.8	1.3	12.00	51
69.3	29.1	2.6	13.10	54
67.2	29.6	3.2	8.57	32

The influence of an ascending content of lead, as shown in the foregoing table, is chiefly noticeable in the elongations, a steady decrease being associated with each increment of lead. Turning to the influence of tin Guillet's results show it to slightly increase tensile strength, but when a content of 1 per cent. is exceeded a marked diminution of extensibility follows. The following table embodies some of the results obtained:—

Analyses.			Mechanical Properties.	
Copper. %	Zinc. %	Tin. %	Maximum stress, Tons per sq. in.	Elongation %
59.42	39.67	0.72	21.6	40
59.35	38.89	1.29	21.8	35
60.03	37.62	2.22	22.8	13

The next series of tests show that manganese, quite apart from its rôle of deoxidiser has a marked effect on the properties of the alloys. This effect may be summarized as (1) sensibly increasing elastic limit and maximum stress; (2) increasing ductility up to a certain content, which is in turn followed by a decrease; (3) increasing fragility from 4 per cent. upwards; and (4) a slow but perceptible increase in hardness with each increment of manganese:—

Analyses.			Mechanical Properties.	
Copper.	Manganese.	Zinc by difference.	Maximum Stress, Tons per sq. in.	Elongation %.
60.0	0.0	40.0	20.25	47
60.1	0.3	39.6	21.85	48
59.4	0.8	39.8	22.15	49
59.7	1.9	38.4	22.55	49
60.3	3.0	36.7	21.75	45
60.8	4.7	35.5	24.55	37
59.6	6.2	34.2	22.55	18
70.4	0.0	29.6	12.70	68
70.6	0.4	30.0	12.90	57
70.3	0.9	29.0	15.55	47
69.7	2.1	28.2	13.10	47
70.8	2.9	26.3	12.90	34
70.5	4.2	25.3	15.05	44
68.9	6.1	25.0	12.45	17
70.2	9.3	20.5	19.40	32

The influence of aluminium on the mechanical properties of copper zinc alloys is shown in the following table. As these results show, an ascending content of aluminium steadily raises maximum stress; it increases, then diminishes ductility, and when present in small quantities increases very clearly the resistance to shock:—

Analyses.			Mechanical Properties.	
Copper.	Zinc by difference.	Aluminium.	Maximum stress, Tons per sq. in.	Elongation %
60.0	40.0	0.0	20.25	47.0
59.6	40.1	0.3	20.55	51.5
59.9	40.3	0.8	19.65	45.0
59.6	38.5	2.9	29.25	14.0
60.4	35.9	4.7	28.00	2.0
70.0	29.6	0.0	8.70	50.0
69.0	29.9	0.4	12.90	59.0
70.0	28.8	0.9	14.45	67.0
70.5	26.4	3.1	21.55	50.0
70.1	24.7	5.2	32.30	11.0

White Brasses.

Copper zinc alloys containing more than 60 per cent. zinc are too brittle for ordinary commercial work. However, where brittleness is immaterial these alloys find an industrial application chiefly in the casting of ornaments, statuettes, fancy buttons, and so forth. Such castings may be made in sand or chill moulds, and owing to the repetitive character of this work the latter type of moulds are usually employed. In composition zinc varies from 60 to 80 per cent., and the following represent three typical compositions:—

	1	2	3
Zinc	80	57	34%
Copper	20	43	66%

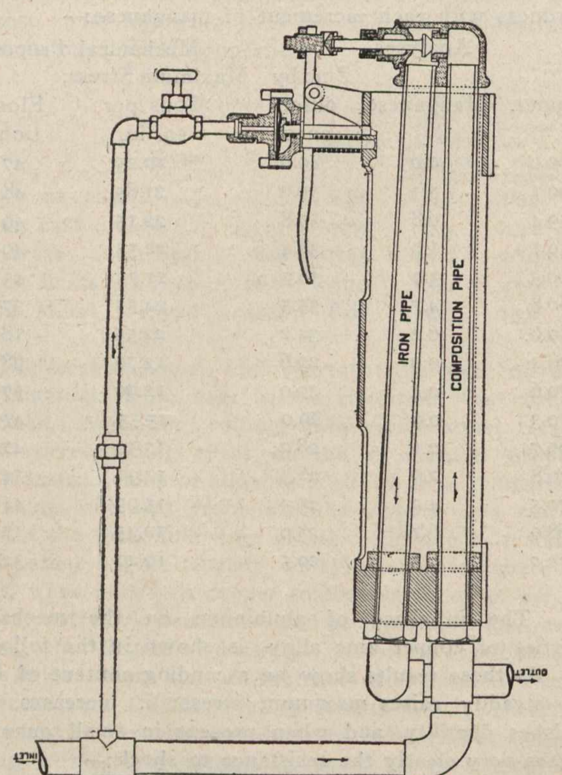
Castings of white brass are artificially bronzed and a series of tints, varying from olive green to chocolate, may be readily obtained.

(Continued.)

* Société d' Encouragement pour l'industre nationale and Revue de Métallurgie, March 1905.

GEIPEL STEAM TRAP.

It occasionally happens that a steam trap is required which shall be tight against steam at pressures varying in the extreme from 300 lbs. down to atmospheric pressure, and at the same time discharge water promptly and as soon as it condenses. In other words, there is a demand for a steam trap which without adjustment will hold tight with steam at say 420 deg. F. to 220 deg. F. and yet will discharge water whenever it collects, irrespective of the temperature between these figures when beneath the maximum temperature. The "Special" Geipel Steam Trap will fill these onerous conditions and requires no adjustment either to prevent the water from backing up or, on the other hand, to prevent its blowing steam. It adjusts itself automatically to the steam pressure available, and in adjusting itself to the steam pressure it obviously adjusts itself to the temperature.



The force of expansion is used as in the regular Geipel Steam Trap to open and close the valve, and the pressure within the pipes is used to control the adjustment of the trap as it varies.

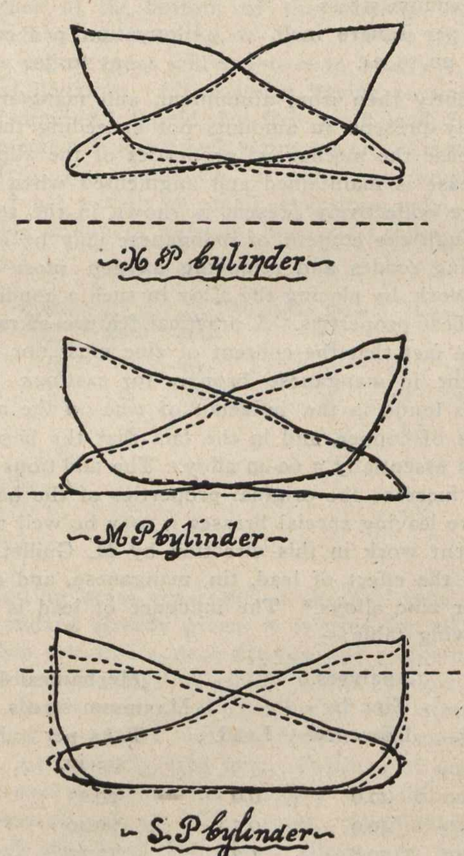
The arrangement is shown in the accompanying drawing. The expansion tubes and valves are the same as in the ordinary type. The lower or composition tube is connected to the steam pipe, the upper or iron tube to the discharge. The valve is at the apex. When the tubes are cold they are contracted, the apex is down, and the valve free to open. When steam enters the composition tube, it expands and raises the apex and valve against the stop in the end of the lever. The valve is then closed. When water forms, it enters and contracts the composition tube, and the valve is again opened until steam enters, when it is immediately closed again.

The position of the stop in the lever determines at what point the valve shall begin to open, and this is operated by the diaphragm which is subjected to the pressure in the steam pipe or receptacle to be drained. When the pressure is low the stop in the end of the lever is low, and conversely when the pressure is high the stop is raised. The amount of movement allowed is exactly that which is necessary to suit the position which the apex or valve occupies at low and at high pressure. This precise adjustment is obtained by the use of a helical spring, against which the diaphragm works. No difficulty has been found in practice in securing this adjustment. As in the ordinary type, this trap may be blown through by hand by pressing down the lever; and there is the same facility for quickly removing the valve, which may be done by simply unscrewing the cover.

The design of an efficient steam trap is attended with considerable difficulty. Two methods of obtaining the controlling power for opening and closing the valve are available, one by gravity or flotation, the other by thermal expansion of metals or liquids.

The force of gravity, i.e., the flotation of a body or receptacle, the motion of which is transmitted to the valve, is, of course, limited by the size or displacement of the float. For high pressure, therefore, it is necessary either to use a large float or to reduce the opening of the valve, while to close the valve quite tight to shut off the steam, there must be a considerable margin of power over and above that which is required for holding the valve merely against the pressure of the steam. Then there is required a box or case of sufficient size to contain the float, and generally the levers necessary to transmit the motion of the float to the valve. When such a box is under high steam pressure, it must not only be made proportionately strong and heavy, but the joint between the cover or door for giving access to the working parts must also be made suitable for high pressure. For these reasons it is obvious that to operate a valve for large and rapid discharge at high pressure, the whole apparatus must be bulky and expensive.

Thermal expansion, however, affords a force for closing the valve, which is limited only by the strength of the materials used. There have been objections to the use of expansion traps in the past, partly, because of the small movement available for opening and closing the valve, and partly because when these traps are adjusted to a given pressure, any access of that pressure causes cutting and straining of the valve, while a fall in pressure opens the valve and lets out live steam.



INDICATOR CARDS FROM S.S. REPTON, SHOWING IMPROVEMENT DUE TO THE USE OF GEIPEL'S STEAM TRAP.

N.B.:

DOTTED LINES WITHOUT TRAPS = 847 I.H.P.
FULL " WITH " = 903 "

For usual purposes and where the variation in pressure is not excessive, the ordinary Geipel Trap overcomes these objections. Owing to the triangular arrangement of the two expansion tubes, the motion is enormously multiplied. This motion may be expressed algebraically thus:

If X = motion of the apex parallel to the base,
a and b = the two sides of the isosceles triangle,
and c = the base of the isosceles triangle,

$$\text{then } X = \frac{a^2 - b^2}{2c},$$

so that by making c small, X becomes great.

In the case of the medium size of the Geipel Trap, for example, the linear expansion of the composition tube with a temperature of say 300 deg. F. above the atmosphere is only 3/1000ths of an inch and of the iron tube about one-half of this.

This movement, which as it stands is far too little to open the valve, is altered from a direction at right angles to the base to one parallel therewith, while it is multiplied about one hundredfold. Thus the objection of too little movement which is found with expansion traps is overcome.

Coming now to variations in pressure, the Geipel Trap is provided with a spring which yields should the expansion exceed that for which the trap is adjusted, so obviating damage by straining or cutting the valve; this meets all variations found in usual practice.

Some engineers require steam traps which shall be tight against steam at all pressures from atmosphere up to the point at which they blow off, and which shall discharge water just as rapidly as it condenses. These conditions had not been met before the introduction of the "Special" Geipel Steam Trap, and could only be met by readjustment by hand. In certain cases, however, where steam is raised from atmosphere to high temperatures, there is no time for adjusting the trap, and in other cases the conditions of manufacture make fluctuating steam pressures and temperatures probable in steam coils where it is of the utmost importance to drain off the water immediately any is present. Such special conditions the "Special" Geipel Steam Trap fills perfectly.

The "Special" Geipel Steam Trap is more expensive than the regular type of Geipel Steam Trap, but where the conditions are as onerous as those pointed out, engineers will probably not object to paying a little more for the apparatus. The importance of the efficient draining of all steam pipes and receptacles requires but little emphasis whether it be viewed from the standpoint of safety to life and machinery, economy in fuel or otherwise. We publish some interesting diagrams from the S. S. "Repton," on which Geipel Steam Traps have been in use for three years.

It will be seen that the pressure in the intermediate receiver is increased from 44.5 to 50.5 lbs., that is 13.5 per cent., while that in the low pressure receiver is increased from 2.5 to 4.5 lbs., that is 80 per cent., the boiler pressure being the same in each case, while the total indicated horse-power is increased from 847 to 903.

The trap has found its way rapidly into the British navy, where it is used on some of the most modern and most powerful cruisers and battleships, and also on the new royal yacht.

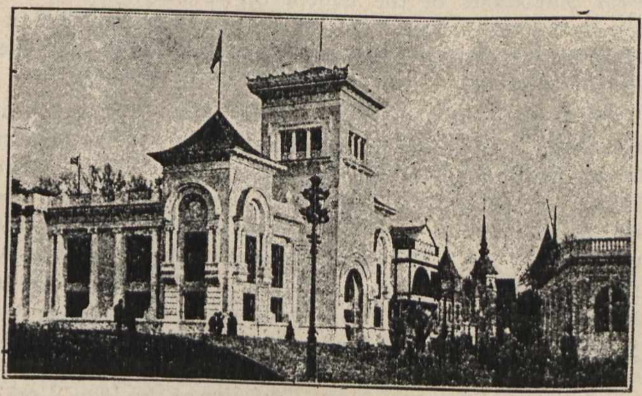
The Canadian Fairbanks Co., Limited, Montreal, are sole Canadian Agents for the Geipel Trap.

THE CANADIAN EXHIBITION AT LIEGE, BELGIUM.

It is gratifying to note the laudatory references appearing in European technical papers to Canada's mineral exhibit at Liege, Belgium. Stahl and Esin, the official organ of the German Trans-Metallurgists, and the most important of the periodicals published in the iron and steel interests, in its August number, speaks of the Canadian exhibit as follows:—

"Of all the foreign non-European countries the exhibit of Canada commands the highest respect and attention of the visitors, both as regards its completeness and practical arrangement; indeed, it is not too much to say that Canada is the only country really adequately represented at the Liege Exhibition.

"The Canadian Exhibition Building, erected in the Ionian



The Canadian Pavilion at the Liege Exposition.

style, is situated in the Park de la Boverie; to the right is located the building for historic art, to the left the palace of art, and opposite the entrance one notices the building of the lace exhibit. It has a length of sixty metres, a width of thirty-five metres, a height of twenty metres, and its entrance is overbuilt by an imposing tower, which bears the Canadian coat-of-arms.

"Of special interest to metallurgists are the specimens of ores, economic minerals and metallurgical products which are exhibited in the rear of the building. Canada, as we all know, is rich in coal, iron, gold, silver, lead, copper, zinc, nickel, cobalt and manganese; quicksilver and platinum occur also, but are of minor importance. The value of the total mineral productions of the country has increased enormously in the last ten years. Of the exhibits may be mentioned the titaniferous magnetites from the Quebec & Lake St. John Railway Co., Quebec; magnetite from the Boyd, Caldwell mine, Bagot, J. P. Renfrew Co., Ontario; hematite from the Broome Company, and hematite from the St. Helen mine, Michipicoten district. Besides these there are exhibited iron ores from the Londonderry mines in Nova Scotia, owned by the Londonderry Iron & Mining Co., Ltd., and hematite and limonite from Cooper Brook, Colchester, N.B.

"Some beautiful manganese ore is exhibited by the Pictou Company, of Bridgeville, N.S. These specimens with their magnificent crystals would be a great acquisition to any mineralogical museum. Of chrome ores are exhibited: Chrome iron ore from Black Lake and the Megantic Mining Co., in Quebec.

"The nickel, cobalt and silver ores from Haileybury, Nipissing district, Ont., represent a value of approximately 60,000 francs. Nickel and copper ores of the Victoria mines in the Algoma district, Ontario, are exhibited by the Mond Nickel Co. The Canadian Copper Co. shows nickel ore from the Sudbury district, Ontario, and also wire, tubes, and vessels manufactured from metallic nickel. It is generally known that Canada supplies over half the world's consumption of nickel.

"Of the rarer ores may be mentioned:—Molybdenite from Harcourt township, Haliburton, and of the Victoria Co., Ontario; from the Alleyn township, Pontiac Co., and Ashfield township, Quebec, from Egan township, Wright Co., Quebec, and from Grand Prairie, British Columbia. Wolframite from Emerald, Magaree, Inverness Co., N.S.; and Scheelite from Willow River. There is also to be seen an unmarked radium ore from Cap d'Or, in Cumberland Co., N.S., coal from Cumberland, B.C., coal oil, peat, graphite, corundum, mica, asbestos, and many other economic minerals in this section of the magnificent Canadian exhibit."

"Of metallurgical products, pig-iron is shown of the following composition:—

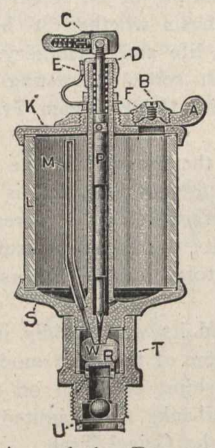
Si.	....2.5	3.45	2.54	2.72	2.67	4.6	5.28	6.72
S.	.....0.022	0.006	0.08	0.007	0.011	0.007	0.04	0.28
P.	...0.96	1.11	0.91	0.98	0.98	.....	....	....

"The Londonderry Iron & Mining Co. have exhibited ferrosilicon with 8.19 silicon, 0.28 per cent. sulphur, and 0.78 per cent. phosphorus. The Electric Reduction Co., of Buckingham, P.Q., show beautiful specimens of ferrosilicon and ferrochrome.—The Canadian Mining Review.

AN IMPROVED LUBRICATOR FOR GAS ENGINE CYLINDERS.

Proper lubrication of vapor engine cylinders is not a minor detail, as no doubt those who operate this style of engine can affirm. The lift as well as the satisfactory operation of an engine depends largely upon proper lubrication, and a device made specially for this purpose should be of interest, not only to gas engine builders, but also to users of gas power.

Illustrated in the accompanying cut is a gas engine lubricator recently placed on the market by The Lunkenheimer Co., of Cincinnati. Its rate of feed can easily be regulated to as fine a degree as desired by means of the knurled screw *D* on top of the cup, which adjustment is prevented from unsetting by means of the flat spring *E* engaging the knurled edge. The feed can be stopped or started by the small snap lever *C*, which when placed in a vertical position opens the needle valve and permits the oil to flow, but when thrown in a horizontal position, the valve is closed. This stopping and starting is accomplished without affecting the regulation, a desirable feature, as considerable time and annoyance is saved by not having to reset the feed after opening the valve.



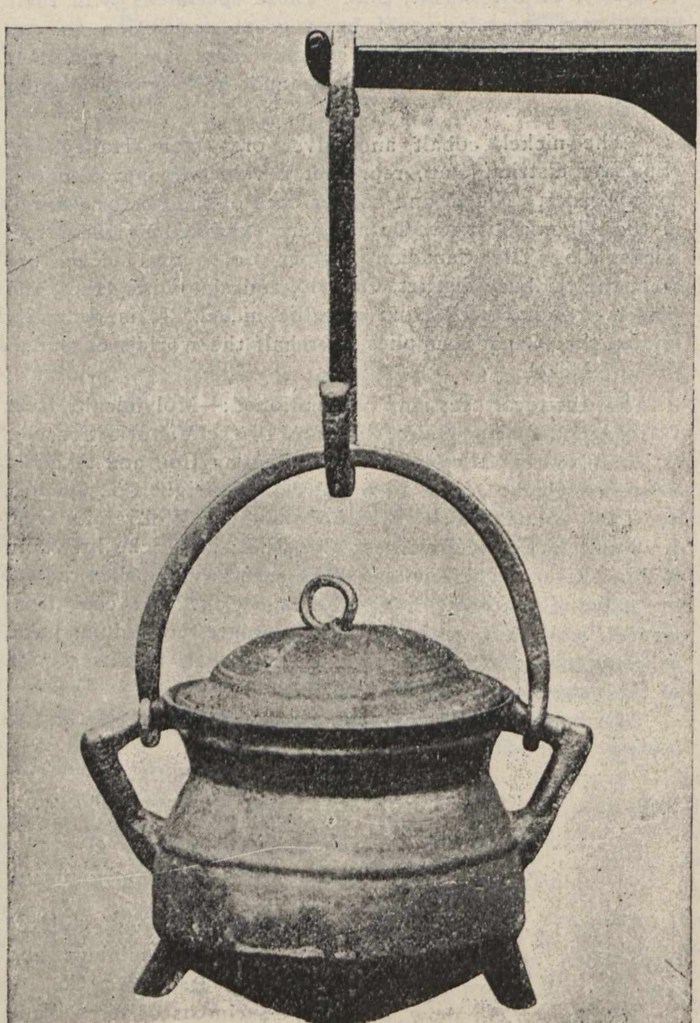
Vertical Section of the Paragon Lubricator.

Oil is poured into the lubricator through a hole in the top of the cup. This hole is covered by means of a slide *A*, which revolves around a central boss on the top *K*, and consists of a loose washer beneath the cap containing the screw *B*. With this screw it is possible to maintain an even and tight bearing of the loose washers over the filling hole, and if these should become worn it is only necessary to turn down the screw *B*, thus preventing foreign matter from entering the cup.

The cup is thoroughly packed, both around the stem and at the top and bottom of the body and sight-feed glass *W*, which is of large size so that the glass will not become splashed with oil and obstruct the view of the oil drops. To clean the glass the upper part of the cup is unscrewed from the base, when the glass can be easily removed.

To provide against the explosions, which will more or less escape past the piston, interfering with the proper formation of the drops in the sight feed and causing the oil to spatter around the glass, the shank of the cup is fitted with a large ball check valve. It has been found, however, that where the back pressure is unusually great, as in oil engines with worn piston rings, the ball check does not entirely remedy the trouble, and the improved lubricator is provided with baffling cap *R*, placed within the sight-feed glass, just above the check valve. The gases escaping past the ball check are effectually muffled and diffused by means of this cap, and do not disturb the dropping of the oil.

With a large passage through the shank and ample clearance around the ball check, a constant even flow of oil which the regulating device is set, will continue until the to the cylinder is insured, and the same rate of feed, for cup is empty.



FIRST CASTING ON THE AMERICAN CONTINENT, 1642.

American history prior to 1775, belongs not to the present inhabitants of the United States only, but to the Anglo-Saxon race. Even Canadians, therefore, will be interested in the casting illustrated herewith; which was the precursor of the vast iron industry in North America.

The kettle was cast at the Sagus Iron Works, Lynn, Mass., 1642. The design is that of a type used in the earliest colonial days, but in its physical characteristics bears evidence of being made of iron cast direct from the blast furnace. It is now kept in a suitable case in the City Hall, of Lynn. The tablet forming the back of the glass case bears the following inscription: "The first casting made in America: Sagus Iron Works, 1642. Presented to the city of Lynn by John E. Hudson, a descendant of Thomas Hudson—(younger brother of Henry Hudson, the celebrated English navigator)—the owner of the site of the Iron Works, to whom the first casting was given."

WESTINGHOUSE ORDERS.

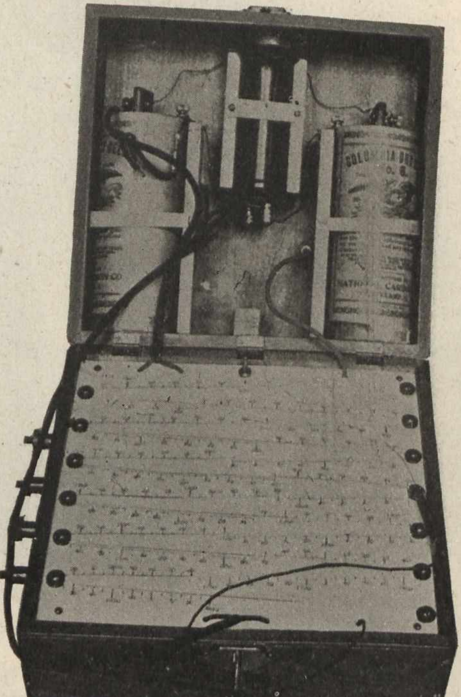
Orders have been received by the Westinghouse Electric & Manufacturing Company from Nelson Morris & Company, for 19 type CCL induction motors varying in sizes from 5 to 50-h.p., and totalling 410-h.p., and for eight motors of the same type from the Decatur Car Wheel & Mfg. Company, Birmingham, Ala.

The Hawiian Electric Railway Company, of Honolulu, has contracted with the Westinghouse Electric & Mfg. Co. for two 1,200-k.w., three-phase, 2,200 volt engine type generators, two 125-k.w. exciters, and seven 500-k.w. oil-insulated, self-cooling transformers.

THE APPLICATION OF THE TELEPHONE TO ELECTRICAL RESISTANCE THERMOMETERS AND PYROMETERS.

As Invented by Dr. H. T. Barnes, F. R. S. C., Assistant Professor of Physics; and Dr. H. M. Tory, Assoc. Professor of Mathematics; both of McGill University, Montreal.

The method of measuring temperatures by the electrical resistance thermometer has been known for a great many years. Over the range from—200° C (—328° F), up to 1,200° C (2,200° F), no instrument can compare with it in accuracy or reliability. Practically unlimited in point of sensitiveness, it offers at the same time a ready means of measurement. Outside of purely scientific research, to which the electrical thermometer has been the greatest boon in the



Telephone Reading Box to be Used With Pyrometer.

past, the arts and manufactures are rapidly recognizing the need of a more accurate knowledge of temperature conditions than has hitherto been possible, and are turning their attention to a practical instrument.

In many processes it is important that the temperature should be known within two or three degrees. A rise of a few degrees above the correct temperature may spoil an anneal, and cost the manufacturer many hundred times the price of an instrument. On the other hand, if the desired temperature is not attained, the anneal must be repeated with a corresponding loss of time, labor and fuel.

In general, there are three classes of thermometric measurement required in practice. In the first class we may include all measurements around and below the ordinary temperature of the air, such as is required in breweries, cold storage plants, public buildings and hospitals. In the second class we may include annealing, tempering, enameling, temperature of cement kilns, boilers, superheaters, flue gases, gas retorts, etc., all of which lie between 100° C (212° F), and 1,200° C (2,200° F). A third class may be made of temperatures over 1,200° C (2,200° F), which lie outside the range of accurate measurement in a region so hot that it becomes unsafe to insert any material directly into the fire to obtain the temperature.

In the electrical resistance thermometer there is no "Cold Junction" uncertainty, as in the case of the thermo-junction, and all temperature variations in the connecting leads are corrected for automatically. It is hence a matter of no moment how far away the bulbs are placed from the centres of measurement. Installations up to a mile have been successfully operated to a degree.

The Instruments Operated by Telephone.

Patented
Canada, No. 87,949, June 1, 1904.
United States, No. 769,364, September 6, 1904.
France, No. 344,718, September 13, 1904.
England, No. 12,253, 1904.

The present apparatus was devised to meet a recognized need for a practical form of electrical resistance thermometer and pyrometer, which could be readily operated in commercial work. It combines many advantages which no other instrument so far devised possesses.

The extreme delicacy of the telephone, combined with a direct reading scale graduated either in centigrade or Fahrenheit degrees, gives the instrument qualities which will commend themselves at once to practical men. Without troublesome methods of reduction, the readings may be obtained in the shortest possible time. Practically, the whole range of temperature may be covered in one instrument, with single or duplex scale, or only a part of the scale may be included where special measurements are required at one particular temperature. Being perfectly portable, with no adjustments to be made when placed in position, there is nothing to get out of order. From its simplicity, anyone can use the instrument and obtain accurate readings. By means of a switchboard, any number of thermometers or pyrometers may be connected to the same reading box situated in any convenient location.

One of the many types of reading boxes is shown in the accompanying photograph. This box, which was recently supplied to the General Chemical Company, has a scale 9 feet long, ranging from 212° F to 1,950° F. All the boxes of which this is one particular type are calibrated in the most approved way, and the scale is that of the standard air thermometer. Each degree is approximately ⅛ of an inch long. The batteries and single bipolar telephone receiver are shown in the cover.

The pyrometer or thermometer bulbs to be used with the box are made in any desired length or thickness, and are attached by flexible or other wires to the binding posts seen on the left side of box. The high temperature bulbs are protected by a porcelain tube, which may be covered by a steel tube to avoid breakage. The bulbs for ordinary temperature are of glass or metal.

All bulbs are made to a standard pattern, and are interchangeable.

Some of the Uses for the Telephone Pyrometer and Thermometer.

For annealing of castings around 750° C to 800° C, the pyrometer is specially adapted. Readings may be made and the temperature thereby controlled to one degree. As a rule, if necessary, this accuracy may be attained also in enamelling furnaces from 800° C to 1,200° C, and in cement kilns.

For boilers, superheaters, flues or gas retorts, an installation of thermometers will be found very advantageous.

The instrument is specially suitable for marine engine trials, for it is unnecessary to keep it in a horizontal position, and the bulbs may be inserted in the most difficult places.

For railway boiler or locomotive testing, the thermometer is well adapted in actual running trials. This has been demonstrated by the Canadian Pacific Railway Company, where the box is placed in the cab of the engine connected with pyrometers in the smoke box.

Much attention is directed to the temperature of large piles of coal. Thermometers placed in position throughout the pile, and connected with the superintendent's office, will enable all parts of the pile to be carefully watched as to temperature rise, and thus save a possible conflagration. A great deal of money is annually lost through want of proper attention to this matter.

This method applied to ships is particularly successful, and, in fact, the many uses to be found for the telephone thermometer in marine work, not only for cold storage, but for naval storerooms, might be set forth in a special article.

For powder magazines in forts and Government stations the thermometer will prove exceedingly valuable.

For observatories or meteorological stations, or for scientific work generally, the instrument will find ready use. The scale which is graduated according to the best scientific methods, will be found useful as a standard for reference in all classes of work.

Although the instruments have not been perfected very long they have more than fulfilled their inventor's expectation as regards accuracy and practicability.

This is shown best by the number of important companies who are using the pyrometer, among these we may mention:—

The Thos. Davidson Manufacturing Company, Montreal; the Montreal Steel Works; the Ross Rifle Company, Quebec; the Camden, N. J., and Hudson River, N. Y., works of the General Chemical Company; the Capelton works of the Nichols Chemical Company; the Canadian Allis-Chalmers-Bullock Company; the Canadian Westinghouse Company; the Canada Iron Furnace Company, and the Canadian Pacific Railway Company.

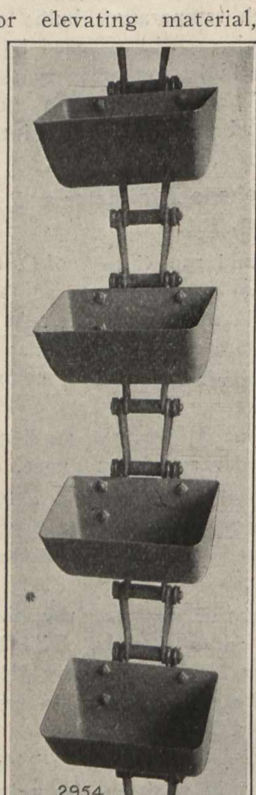
The Robert Reford Company, of Montreal, being always alert for the latest improvements in the steamship freight carrying trade from Montreal, are installing the telephone thermometer in the boats of the Thomson line for reading the temperature of the cold storage and cool air compartments, at any time, from the chief engineer's room, thus enabling a very careful check to be kept on the temperatures at which the rooms are kept.

The instruments are now being manufactured and full information may be obtained by writing to Telephone Pyrometer, No. 17 St. John Street, Room 17, Montreal.

* * *

STEEL BUCKETS FOR ELEVATORS.

Pressed steel in the manufacture of conveyor buckets for elevating material, is being used by the Link-Belt Engineering Company, of Philadelphia. The new buckets made in one piece, free from seams and rough surfaces, are from 20 to 40 per cent. lighter than malleable iron buckets of corresponding sizes; the accompanying illustration shows the uniformity of gauge and the symmetrical design. The superiority of the new pressed steel buckets over cast buckets is obvious—compact and light, they obviate the destructive wear on chain and sprocket wheel, and prolong the life of the elevator, a factor of importance to the users of this class of machinery. Where cement, sand, grain, coal, gravel, and materials of a like nature are to be handled, the use of these buckets should prove materially advantageous. Users of japanned or galvanized buckets will recognize the superior qualities of pressed steel in the service demanded by the conditions that exact special surfaces in conveying buckets.



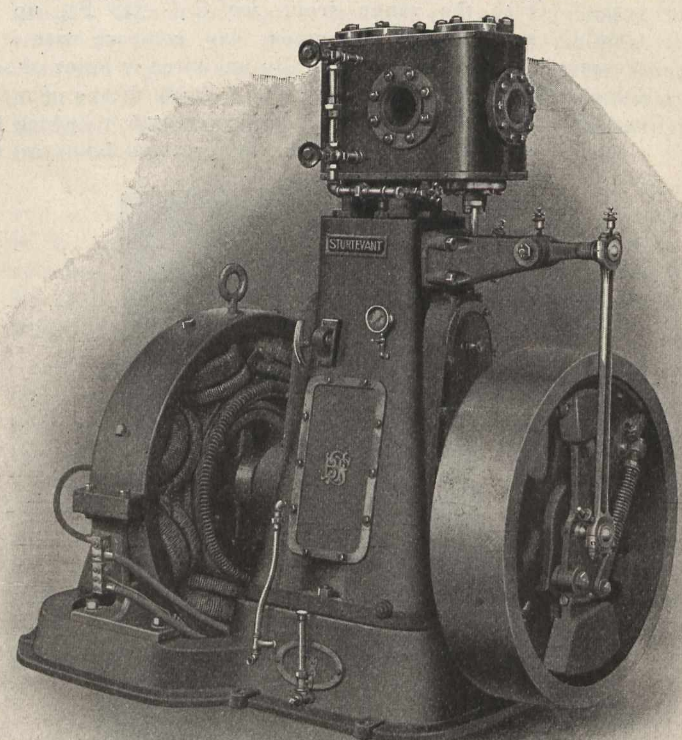
* * *

A STURTEVANT GENERATING SET.

The B. F. Sturtevant Company have been developing a very complete line of small and medium size generating sets of exceptionally high efficiency. Among these is a series running from 7½ to 50 K. W., as shown in illustration.

The engine of this set is of the vertical enclosed automatic type, with cylinder 9" in diameter by 8" stroke. The generator was specially designed for direct attachment to the engine, and the output is produced at 350 R. P. M., with 90 pounds of steam. The shaft is 3 7-16" in diameter; the crank pin 4" diameter by 4½" long, and the complete set weighs 4,900 pounds.

The apparatus is fitted with approved appliances for



lubrication, etc., and the regulation is accomplished by means of a Rites' flywheel Inertia Governor, the speed variation being limited within 2% of full load, and no load.

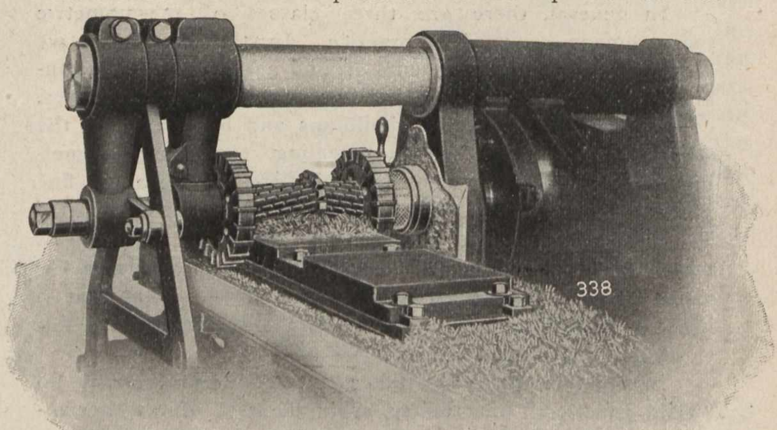
* * *

MACHINE SHOP NOTES FROM THE STATES.

By Charles S. Gingrich, M.E.

XX.

In many of the shops throughout the States I have noticed machined parts of the general character shown in the illustration. It is important that the top shall be true



and flat, and at the same time the slot shall be dead parallel with the finished edges.

In the majority of shops such work is done on the planer. Under the very best conditions, using two heads at a cutting speed of 45 ft. per minute, it is necessary to change the tools for the top, sides, and slot. Even with a large planer, stringing a great number of pieces on the table, about half an hour is required to chuck and plane one piece of the size shown.

The quickest and most advanced method of doing this work is shown in the above illustration of one of the larger Cincinnati millers. In this case the piece is 14" long by 10¼" wide by 1¾" thick, with a slot ⅝" wide by 1" deep. The cut is about 3-16" deep all round and the slot is cut from the solid. The largest cutters are 8" diameter, spiral mills 3½" diameter, slotting cutter 5⅜" diameter. The top, slot and two edges are milled in one cut at a table travel of 4.2" per minute. The entire operation including chucking, requires just 15.6 minutes, less than half the planer time, and in addition the pieces are finished more accurately.

This is only one of the countless jobs which all shops must sooner or later do by the more modern method, the saving effected being evident from the above example, which explains why the progressive shops are now installing more and more millers every year.

FOWLER'S BOILER ROOM CHART.

We deem ourselves fortunate in having among our increasing number of readers some of the more intelligent stationary engineers of Canada, hence we are always glad to introduce anything new, technically, which may be of utility in the line of their responsible craft. The educational chart illustrated above—reduced from 28 x 14 inches—sets forth in isometrical perspective the mechanism and appliances appertaining to a modern boiler room.

The equipment consists of water tube boilers, ordinary grates and mechanical stokers, feed water heaters and pumps. The various parts of the appliances are shown broken or removed so that the internal construction is fully illustrated. Each part is given a reference number and these with the corresponding name is given in a glossary printed at the sides. The Chart, therefore, serves as a dictionary of the boiler room, the names of more than two hundred parts being given on the list.

Steam Boilers.

1.—Never allow boilers to be worked at as high a pressure as tested.

2.—Keep the water at water pointer, and no higher or lower.

3.—Never allow priming if it can possibly be avoided.

4.—Never allow the safety valves to be over-loaded. Try them often when raising steam.

5.—Always see that the steam gauge is in good working order.

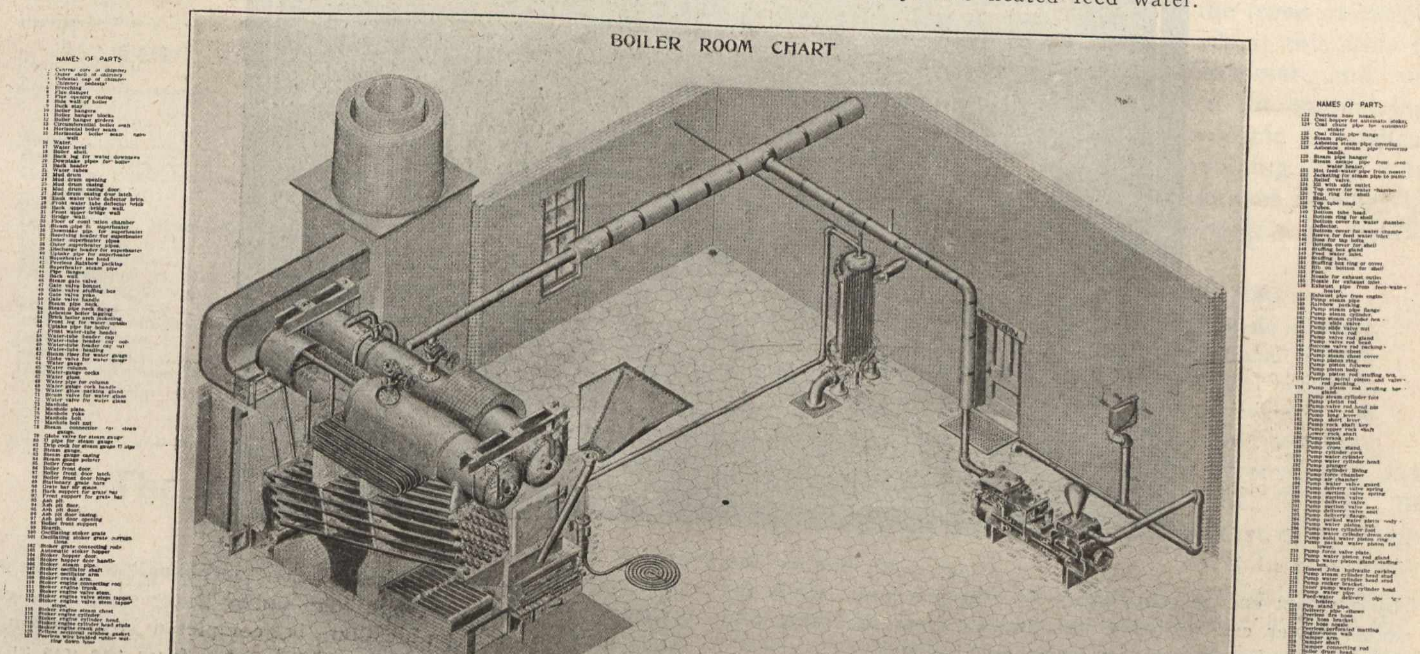
6.—Have boiler periodically examined and tested.

7.—Always see that the float is in good working order.

8.—Examine the blow-off tap periodically.

9.—Never allow excessive firing, only open fire door when necessary.

10.—Always use heated feed water.



It is educational in that, with it, the student will be able to learn of the construction and arrangement of the best type of boiler plant, and examine into the relations of the various parts, while the glossary gives the name of each piece and part that is shown.

This latter is so arranged that the names of any part can be readily found, or the name being given—the part and its functions are readily determined.

This unique chart, 28 x 14, can be procured at the office of THE CANADIAN ENGINEER, 62 Church Street, Toronto, for the sum of 25 cents, net.

Boiler Catechism.

By William Tate, in Science and Art of Mining.

Q.—What are the principal points to be observed for the safe working of steam boilers and engines? Give these in detail, and the steps you would take to have same effectually carried out.

A.—Some of the principal points to be observed for the safe working of steam boilers and engines are as follows:—

11.—Never allow joints to leak on boiler; report all defects immediately.

12.—Never allow boiler to work when leaking.

13.—Never allow valves to leak; know that the back pressure valve is tight.

14. Blow scum off water two or three times a day.

15.—Clean boilers at least once a month; don't blow off under pressure.

16.—Use as clean feed water as possible.

17.—Never allow rapid contraction or expansion by bad firing and rapid cooling.

16.—Ascertain by careful inspection that the boiler mountings and feed pump are in reliable working order before getting up steam.

—The Dominion Iron & Steel Co. has an average daily output for the past three months from the open hearth furnaces of 450 tons of steel, of which about 350 tons have been used in the rail mill since it started. The rest went to the billet mill.

EXTRACTS FROM AN ENGINEER'S NOTE BOOK.

Suction Gas Producer Plant and Engine.

The most common method of getting energy from coal is to transfer the heat from the coal to water, and use the steam thus formed in a steam engine. This plan, although much used and in many cases well suited to the work, is not very economical, as it requires from 2½ to 6 pounds of coal per horse-power per hour. Another way of stating the performance is to say that the steam boiler and engine make available only about 12 per cent. of the energy in fuel.

The gas engine, if operated with a cheap gas, will develop 1 horse-power on 1 pound of coal, and makes available from 20 to 25 per cent. of the energy in the fuel. The reason for this great difference in efficiency is the greater temperature of the gas. In the steam engine, 400° F. is a high temperature; but the gas engine shows 1,800° to 2,000°.

Thermal efficiency depends upon the range of temperature; that is, if steam or gas in the cylinder begins its work at high temperature and leaves the cylinder comparatively cool, the efficiency will be high.

The above statements regarding percentages and efficiency mean much more to the engineer than to the business man. For the latter, let us say that 1 horse-power developed by a steam engine costs about ½ cent per hour; while the same power can probably be obtained from the same coal if a gas engine is used, for less than ¼ cent.

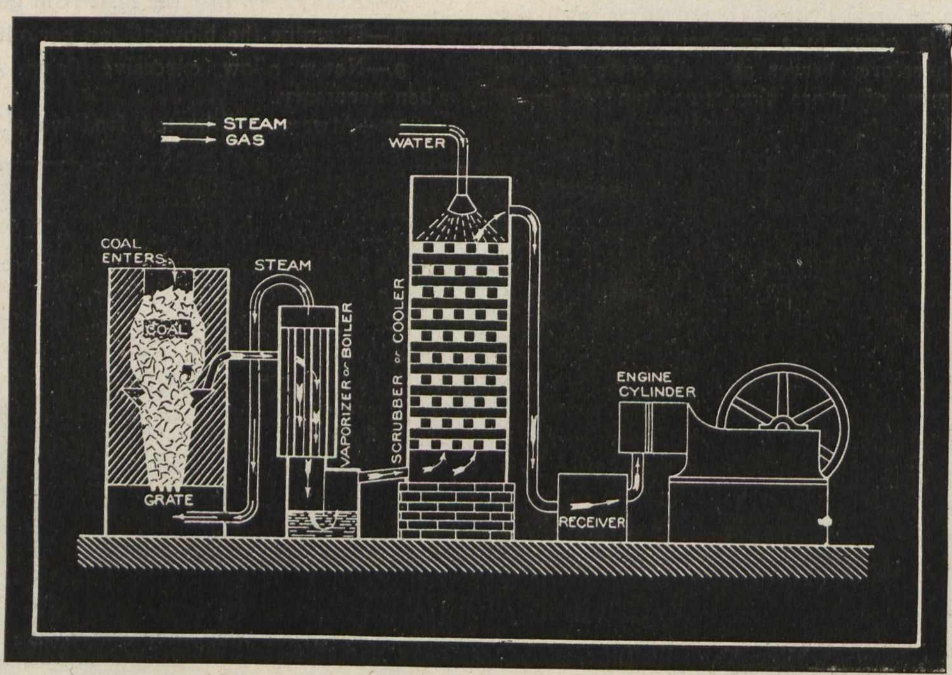


Diagram of Suction Gas Producer Plant and Engine.

Producer Gas.

High efficiencies do not prove that financial gain will always result from using a gas engine. In fact, if a gas engine is supplied with ordinary illuminating gas at 75 cents to $1 per 1,000 cubic feet, the cost of power would be about the same as in the case of a steam engine, even if the thermal efficiency were much greater. This is because of the high cost of illuminating gas. To get the full advantage of a gas engine, the gas must be of low cost. This means that, although the gas must be tolerably clean, it need not be made in retorts; it does not need so much cleaning; nor does it require an illuminant.

The cheap gas made for this purpose is called "Producer Gas," and the apparatus in which it is generated is called a "Gas Producer." This gas has a heat value of about 140 heat units per cubic foot; and a pound of coal will yield about 75 cubic feet of gas.

Producer gas has only about one-fifth the heat value of illuminating gas; therefore five times as much must be used; but the five times as much costs only 10 or 12 cents, so that there is a saving approximately equal to the difference between 10 or 12 cents and 75 cents to $1.

Formation of Gas.

It is a well-known fact that if coal is burned with a plentiful supply of air, Carbon dioxide gas is formed; this gas cannot be burned, because complete combustion has already taken place. If, however, the combustion takes place with a limited supply of oxygen, the gas formed is Carbon monoxide, which is combustible.

In the manufacture of producer gas, a mixture of steam and air passes through a bed of incandescent fuel in a closed furnace. The fuel is converted into gas, and only the ash remains. The steam and air should be so supplied as to maintain a uniform temperature in the fire. Too much steam kills the fire, and increases the percentage of carbon dioxide, which is undesirable. Too much air results in a poor quality of gas. The air furnishes the oxygen for combustion and for the carbon monoxide gas. The steam furnishes oxygen and also hydrogen. The oxygen from the steam renders unnecessary a great supply of air, which would bring in a large percentage of nitrogen, undesirable because inert.

For furnace work—that is, when the gas is to be used as fuel beneath a boiler—the producer gas is led directly from the producer to the boiler, without cooling or cleaning.

For gas engines, the producer gas is first cooled in some form of cooler or economizer; this may be made like a small boiler, having the gas in the tubes and air surrounding them. The gas next passes to the "scrubber," where it is cleaned by flowing through coke and by water spray. After this process, the purification is completed by passing through sawdust or shavings. This takes from the gas any moisture it may have retained. The gas is now ready for the gas-holder, which is simply a storage tank or regulator.

Types of Producers.

There are three types of gas-producers—the pressure, the suction, and the automatic. The third type is a combination of the features of the first two.

In the pressure system, the air and steam are supplied under slight pressure; and the gas throughout the system, even to the engine, is under pressure. This type is adapted to large power, especially if several engines take their supply from the same producer. It occupies considerable floor space, but is suited to a greater variety of fuel and cheaper grades than is the suction type.

In the suction type, the air and steam are delivered to the fuel at less than atmospheric pressure because they are sucked through the bed of fuel by the engine piston. For this reason there can be no leaks in the system. This producer is adapted for the generation of gas for power only; and as the receiver, if one be used, is small, this type of producer takes up less floor space. The gas is not so uniform in quality as that made by the pressure type, although the difference is slight.

The sketch on the blackboard shows a sectional view of a suction gas-producer, with the gas engine.—(Carl S. Dow, in "The Technical World.").

The Canadian Engineer.

ESTABLISHED 1893.

With which is Incorporated

THE CANADIAN MACHINE SHOP

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, LOCOMOTIVE STATIONARY, MARINE, MINING, METALLURGICAL, AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

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

OFFICES—62 Church St., Toronto. TELEPHONE, Main 4310.

BIGGAR-SAMUEL, LIMITED, Publishers.

THOS. ROBERTSON, President.

JAS. HEDLEY, Vice-President.

EDGAR A. WILLS, Sec.-Treas.

SAMUEL GROVES, Editor.

J. J. SALMOND, Advtg. Representative

Editorial matter, cuts, electros, and drawings should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertisements should be in our hands not later than the 10th of the preceding month.

PRINTED AT THE OFFICE OF THE MONETARY TIMES PRINTING CO., LIMITED, TORONTO, CANADA.

TORONTO, CANADA. OCTOBER, 1905.

The Coming Revolution.

In 1892 there flourished on the southern shore of Lake Erie, what were then recognized as the finest machine shops and foundry in the western hemisphere. The plant was specially designed for the making of cable machinery for street railways. Over twenty extensive installations had been made in the great cities of the American union. In two years, this prosperous business vanished like a dream; for electricity came in and cable machinery went out. With characteristic audacity, the American street railway companies, tore out by the roots the obsolete underground cables, and threw aside the eight-mile-an-hour, oil-lit cars, with Jack-in-the-box controlling a lever; and in place thereof, substituted electric motor-driven cars, operated from overhead trolley, lighted with electricity, and capable of making a speed of twenty miles an hour. Keen-sighted business men like George Westinghouse, with prescient instinct for interpreting the "signs of the times," grasped the opportunity, and laid the foundation of colossal fortunes. Another startling transformation at the period indicated, was the passing of the rope-driven overhead travelling crane—a line of manufactures for which the Walker Co. had also become famous. That shrewd Welshman, the late Thomas Morgan, of Alliance, Ohio, perceiving a golden opportunity, began to make a specialty of electric travelling cranes; and it was not long before rope-drive cranes, with their cumbersome system of square shafting, and auxiliary take-up devices, were thrown on the scrap heap, and electric cranes erected everywhere instead. These revolutionary changes in engineering were not made without somebody being hurt; for the pathway was strewn with idle works, obsolete machinery, and specialist engineers, who knew all about the old lines, but had neglected to prepare for the new. It is the price of progress. We have cited these object-lessons of the past, as a peg whereon to hang an argument.

It was Josh Billings who said, "never prophesy until you know." But just as in 1753, that keen man of the world, Lord Chesterfield, was able to predict the French Revolution, from the signs of unrest and disintegration which he beheld in Paris. And just as the meteorologist, with reports in his hand, gathered from all parts of the world; and inductively reasoning therefrom in accordance with the doctrine of probabilities, can foretell with some degree of certainty the coming weather, so, an outlook committee, with wide industrial experience, and reliable technical data before them, received from all parts of the globe, can predict with approximate accuracy the trend of events in the domain of Engineering. Such at this time is the attitude of THE CANADIAN ENGINEER, and we hesitate not to warn our readers that the engineering world is about to witness another cycle of radical changes in operative practice; involving loss and sacrifice on the one hand; but triumphant mastery of the forces of nature, and consequent gain in wealth and civilization on the other.

In our August issue we predicted, that—

> **within five years from now the electric furnace, for smelting purposes, will be a commercial success. When that time arrives the iron and steel industries of Canada, with cheap ore, coal and motive power in abundance, will go forward with leaps and bounds.**

This optimistic pronouncement of ours, has just received powerful support, for "The Globe," of September 13th contains a lengthy report of an interview at Ottawa with Dr. P. L. T. Heroult, of France, probably the greatest authority on the electric furnace for ore smelting, who is about to spend at Sault Ste. Marie, the $15,000 set apart by our public-spirited Dominion Government, on experiments with the electric furnace, in the smelting of the refractory ores of Canada. Dr. Heroult is reported as follows:—

> In ten years Canada will have become a great metallurgical country. You will see an iron industry in the Dominion larger than in any country in the world.
>
> When asked what the successful smelting of iron ores would mean to Canada. Dr. Heroult said:—"Pig iron is the basis for structural and other steels. At present Canada expends fifty and sixty millions of dollars in buying steel abroad. The idea ought to be to make that steel in this country out of Canadian material by the aid of Canadian water power and Canadian labor. Even if the cost of making iron and steel here should only equal the cost elsewhere you would keep in Canada the money you now send abroad. But we expect the cost of manufacture will be less here. Think of what it means. The retention in Canada of sixty millions of dollars now yearly spent abroad, the supplying of the new demand for steel rails, structural steel and other

classes of the product which has arisen in consequence of the country's development, the profitable sale of your surplus product in foreign markets, and the creation in this country of numerous other industries more or less dependent upon iron and steel. As to the iron resources of this country, from all that I can learn they are vast indeed. In Sweden the quantity of ore in sight is sufficient to supply the markets of the world for one hundred years. If we were to compare the quantity in Canada with that in Sweden I should say Canada has three times as much."

It will not be many years before the blast furnace, for smelting ores; puddling furnace, for producing wrought iron; Bessemer converter; open-hearth furnace and crucible for the making of steel, will form *historical* chapters in metallurgical text-books. The authorities in our technical schools, colleges, and universities should, therefore, make the electric furnace the chief objective in teaching the engineers of the future, chemistry and electricity as applied to metallurgical science.

In our next issue, we purpose pointing out, along the same line of thought, rocks ahead in mechanical engineering.

Editorial Notes.

Americans in Temiskaming.

On August 19th, the "Mail and Empire," of Toronto, did us the honor to copy our August editorial, entitled, "The Industrial Outlook," and courteously acknowledged the source from whence it was taken. It has come to our turn to copy a wise deliverance from the pages of our contemporary, which we unhesitatingly endorse:

In some quarters concern is expressed at the interest taken by Americans in the ore deposits of Temiskaming district. Attracted by the remarkable discoveries made there, hundreds of mining men from the other side of the line have gone into the district to locate and acquire claims. When a promising claim is offered for sale these newcomers are usually keen bidders for it. This activity excites apprehension in the minds of sane Ontario people, and moves them to suggest that measures be taken to prevent aliens getting possession of the district. It is highly desirable that Canadians or other British subjects should take the lead in developing the mineral wealth of the Temiskaming country, and that they should receive the fair fruits of their enterprise. But the working of the mines and the rendering of their contents into merchantable products are of more public importance than is the pecuniary advantage of any individual, whether citizen or alien. The minerals are in the earth, and can be of no use to the country until they are taken out and utilized. If in our own country the enterprise required for their conversion into wealth is lacking, then it ought to be welcomed when it comes forward from some other country. Citizens of the United States could be debarred from the right to hold mining lands in Ontario; and to place them under such a disability would be no more than is done in several of the States with regard to aliens generally. But it would be illiberal, and would retard the development of the province's mineral resources. The fewer restrictions there are on the buying and selling of mining rights the less is development likely to be checked by the speculative holder. It is indispensable that our mines be opened, whether by foreign capital or by Canadian. But it is desirable that the series of manufacturing processes to which the ores are to be subjected should be carried on as far as possible in Canada.

If the anxious people would try and enlist British capitalists to buy up and stake out the mineral lands of the Dominion, with the same alacrity they have exhibited in buying up shares and stocks in the breweries of the United States and Canada, a good work for the Empire would be done.

Blast Furnace Blowing Engines.

Since the days of Dud Dudley (1619), the blast furnace as an appliance for reducing iron ore from a mineral condition to a metallic state, has changed very little. The improvements made have been mainly along the lines of economy; reduction of fuel, and utilization of waste material on the one hand, and increased output on the other; the latter advantage being due largely to increased blast pressures. Fifteen years ago five to seven pounds blast pressure per square inch at the tuyeres was the general practice, but since then, American daring and enterprise has raised the pressure up to as high as fifteen pounds, and even higher. This radical change was made in many instances with the old blowing engines designed for low pressures, and as a consequence, not a few exhibited signs of distress, and some went to pieces; since they were incapable of withstanding the abnormal stresses which the new conditions involved. With our own eyes we saw the—English like—fixing and patching of such old engines at the Braddock furnaces of the Carnegie Steel Company.

Necessity is the mother of invention. Pictures of the old engines went into the antiquarian museum; obsolete patterns were broken up, and the old reciprocators were torn out and sent to the scrap heap. Among modern engineers who have made valuable improvements in recent blowing engine practice to suit the new conditions, may be mentioned Julian Kennedy; whose patented piston inlet and outlet air valves, are among the good things in recent blast engine design. This device forms part of the "Morgan" blowing engine described and illustrated on another page.

Technics Only.

We deem it necessary to explain to some of our readers why we have omitted to give an extended report of the Convention of International Union of Steam Engineers, held in the Labor Temple, Toronto, September 11th to 16th. We can assign a convincing reason, viz.; because our columns are not open for discussions of strikes, lock-outs, "Chamberlainism," and the momentous questions at issue between capital and labor; only educational subjects, and technical matters of interest to engineers generally. At the recent Convention the proceedings were exclusively confined to the former; the design, construction, and operation of modern steam engines and boilers were themes conspicuous by their absence. We have no complaint to make; the I.U.S.E. has a perfect right to conduct its proceedings in its own way, no man outside its ranks saying nay. But inasmuch as The Canadian Engineer is the oldest "engineering journal of Canada;" with the largest circulation in the Dominion, and daily increasing its already large circle of readers, we are expected to keep our constituents informed of all movements in the engineering world; hence when we are practically silent about the sessions of an important organization like the I.U.S.E., some explanation is necessary.

Good Things in Our Next. We have received, too late for this issue, data for three graphically illustrated articles, (1) F. B. Utley's famous lecturette on the "Stationary Engineer;" (2) W. C. Mitchell's reversing gear: a unique invention; (3) the Hurst, Nelson Storage Battery Electric Locomotive; and (4), the Pearl Square Auger; a labor-saving device of great utility, destined for wide use. These and other matters of unusual interest will appear in our next.

* * *

The Man of the Future.

By Frank H. Taylor,
Vice-President Canadian Westinghouse Company.

[This is an address delivered before the Electric Club, Pittsburgh, and intended to encourage the young men of his audience, many of whom had recently graduated from college—both those who had adopted a business career and those who had specialized in Electrical or Mechanical Engineering, and were now in the swing of their apprenticeship course. It should be read and pondered by every young Engineer in Canada.—Editor.]

I am of a generation that is now taking the severe burden of business affairs. You are of the succeeding generation. Upon you the load of responsibilities will descend and to you belongs the promise of the future.

We live in a world where things repeat themselves, an old world where men have lived and wrought through many generations. The great fundamental truths remain as unshaken to-day as they did thousands of years ago. Some of these were taught us at our mother's knee, and truths they were, are and ever will be. The fundamental laws of honest business have not changed. Yet every morning brings a new day and every generation has for its own, new opportunities as well as new requirements.

I could not have prospered if I had followed the business methods of my grandfather. He did well as a farmer where no man of his class can now make a living. Neither could I have followed tanning as it was done by my father before the application of modern chemistry to that industry. During a business life of twenty-eight years I have seen a great revolution from the prosperous individual business to the small corporation, through many steps to the great modern organization of to-day, which may be said not to have existed at all when I left college. We see, therefore, that the methods of only a few years ago could not continue unchanged.

The Joy of Leadership.

As history has judged other generations by the work of its leaders, so it will judge yours. Let us hope there may be one at least of these leaders here to-night, but I fear we can do or say very little to create such men. Those with whom I have come in contact were men who discovered their own masterful qualities and were not selected by anyone. There is always something indescribable about men of power, and it pays to be often in their presence. Fearless, simple, direct, bearing their heavy burdens without complaint, they deal with the tremendous problems of their time. There is, too, a real joy in leadership that no man with the necessary genius ought to forego. Some day the trumpet note of your generation will sound and your leaders will spring into their proper places. They will force themselves forward in this or in other companies, and will naturally take their rank, welcomed alike by younger and older.

There should be among you the keenest interest to detect your leader. As you watch and listen someone of you will catch the rhythmic note of the new day. That which is in error will be brought to light. Things as they stand to-day are not final, and a new leader will direct you by effective steps, to the needs of your time. I do not look for a revolutionist but for one who in a patient, masterful, able manner will lead into safer and sounder paths. We cannot all be great, but it is honor and joy enough for most men to be the loyal and faithful captains without whom the work of the great general must go for naught.

There is no reason why any of us should fail in efficient service, provided we keep just a few true things in mind. My observation has extended over a time long enough to assure the man of twenty-five that by a diligent and intelligent pursuit of the work that lays at his hand, he will prosper. Look forward to your careers with joy and cheerfulness, with courage and confidence. Lead simple, normal, happy lives ready at any moment to grasp firmly the first clear opportunity for wider experience.

Your intellectual development, like your physical development, does not depend on the amount and variety of food you take in. A sound digestion is the essential thing. Above all things, your experiences need to be digested properly. I recall that I went at my apprentice work carefully and deliberately. I did first one disjointed thing and then another, and finally I was rewarded for the thought I gave to the subject by finding that these separate things settled themselves in their proper places, and I caught the essential binding link so that all that went on around me became part of a complete scheme, the unity of which was revealed to me. I think if I were an apprentice in a great company's works I should hunt up some place where work had congested, and I would ask for a chance at the job. I would master it in such a way that I would forthwith be intrusted with a continuance of duties that would tax my resources and insure my growth. A mark is put upon such a man.

CORRESPONDENCE.

RAINY RIVER SENSATION DISCOUNTED.

The Mining Review, of September 5th, contained the following editorial note:—

"Fort Frances, Ontario, is much delighted with the report of a Dr. Lawrence, who, in company with Mr. J. H. Hall, has recently visited the iron region north of Fort Frances and near Pipestone Lake. Dr. Lawrence is reported to have said that he considers the Pipestone range as the 'greatest iron range on this continent.' It is regrettable that the Doctor did not impart to the local reporter some facts as to the composition of the ores, their contents in iron, silica, sulphur, etc., and some equally important facts as to the freedom of the deposits from intercalated bands of stone. Such information might qualify the word 'greatest' in the Doctor's statement."

With a view of getting at the facts we sought Dr. Lawrence, and have pleasure in placing before our readers his interesting and conservative statement as to the outlook in the Rainy River district:—

Sault Ste. Marie, Ont., Sept. 26, 1905.

Editor Canadian Engineer, Toronto.

Dear Sir,—During my last stay in Fort Frances the manager of the Bank of Commerce called my attention to some startling newspaper articles, alleged to be a kind of an interview of me. Investigating the matter I found out that the newspaper men had shown more good-will than good sense, and I felt more than uncomfortable, being placed in the public lime-light the way these gentlemen have done. The summary of my opinion of the Rainy River district is this, that there are very fair showings of iron, but to pronounce any opinion as to the extent, or the value of the properties would at present be hazardous to any man who values his professional reputation, as no development work has been done on any of the properties yet. It will take some time and good hard and earnest work—not savouring the least from "booming"—before the Rainy River district will regain the confidence of the mining investors—*vestigia terrent.*

Another feature that might induce capital to go into the district is some enormous outcrops of iron pyrites, measureing close to one hundred feet across in places, and containing 45 per cent. in sulphur, besides small values in copper and gold. As the country contains an inexhaustible supply of pulp-wood; and electrical power will shortly be available in Fort Frances at very moderate rates, I feel convinced that the manufacture of sulphuric acid and sulphite pulp could be carried on successfully in the district.

The gold mining industry may be revived in the future, as I have every reason to believe that there are legitimate mining prospects in the district. But "gold swindle" killed the district, and I think that gold-mining will never be able to induce capital to come in before the other mineral resources have rehabilitated the country. Yours truly,

S. LAWRENCE.

Paul L. T. Heroult.

The famous Electro-Metallurgical Engineer, who has been engaged by the Canadian Government to conduct experiments on a large scale at Sault Ste. Marie, with the electric furnace, in the smelting of refractory iron ores.

Of European electrochemical and electrometallurgical Engineers none is better known all over the world than Dr. Paul Héroult, the famous pioneer of the electrometallurgy of aluminium and steel. While France is proud to claim him as a Frenchman, the results of his work belong to the world.

Paul Louis Toussaint Héroult was born at Thury-Harcourt (Calvados, Normandy), on April 10th, 1863. Since his

grandfather lived in England he spent his youth's happy days partly in France and partly in England. He was educated at the Lyceum of Caën, Normandy ,and later at St. Barbe, in Paris, where he graduated in 1882, to enter the Paris School of Mines (Ecole des Mines). From 1883 to the beginning of 1884 he served in the French army and then returned to the School of Mines, but on account of the death of his father he was soon forced to quit his studies in order to conduct the business of his father's tanning works.

However, Héroult continued there his metallurgical researches. He was specially interested in the electrochemical production of metals. He bought a small Gramme dynamo of 1.5-h.p., which he replaced in 1886 by another small machine giving 800 amps. at 15 volts. This machine was specially built for his aluminium process, for which he had applied for patents in the same year. Héroult's revolutionary work and success in the aluminium industry is so well known to our readers that nothing further need be said here. In 1887 he became the technical manager of the Neuhausen aluminium works of the Swiss Metallurgical Co., where his process is in use up to the present. He then started an aluminium plant in France, at Froges, Isère, for the Société Electrometallurgique Francaise. About the same time he made two trips to this country, where, meanwhile, independently of, and simultaneously with him, Charles M. Hall had worked out his aluminium process, and had started the works of the Pittsburgh Reduction Co.

After his return to France, Héroult assumed the management of the Froges works, but after the erection of a larger water-power plant in La Praz, Savoy, he became the general manager of these new works at La Praz, where he still resides. Dr. Héroult married Mademoiselle Chateau, and has five children.

To show what a broad man Héroult is, it may be mentioned that in the erection of the La Praz works he proved his ingenuity as a hydraulic and mechanical engineer, since he modified the original designs of the water pipe line over the Arc River, so as to diminish the first cost very materially. The designers wanted to erect a special bridge for the support of the pipe line, while Héroult found by mathematical calculations that it would be possible to construct the pipe line in form of an arc without any further support than the two pillars at both sides of the river. In 1892 the power developed at La Praz was 3,000-h.p., which was increased to 13,000-h.p. in 1895.

Héroult's electric aluminium furnace, which by the addition of a tap-hole was rendered a continuous apparatus, became in his hands the instrument for numerous further researches. In it he made the first commercial calcium carbide produced in France. In it he undertook, for the Société Electrometallurgique de Froges, the manufacture of artificial corundum, ferrochrome and ferrosilicon, and thus he was led to his researches on the use of the electric furnace in the iron and steel industry, which is now in the foreground of interest. Héroult's work in this field has been so often described in these columns that it must suffice here to give references to these descriptions (our Vol. I., pp. 63, 287, 449, 467,; Vol. II., pp. 408, 481; Vol. III., pp. 45, 155), and to state the fundamental principle, which is the production of an artificial slag above the fused bath, the carbon electrodes being suspended into the slag without reaching into the bath itself. In this refining furnace Héroult states that at a cost not exceeding 50 cents a ton, he can make out of any steel delivered in the molten state (*i.e.*, as tapped out of a Siemens furnace or a Bessemer converter, a metal of any desired composition containing less than 0.01 sulphur and 0.01 phosphorus. By operating this electric furnace in connection (not in competition) with existing open-hearth or Bessemer converter plants, Dr. Héroult predicts a revolution in the quality of the steel used for many industrial purposes.

The main point is that he has made steel on a commercial scale in his electric furnace, and has sold it in competition with crucible steel for nearly three years. His company's exhibit at the St. Louis World's Fair received the grand prize.

As another example of Dr. Héroult's versatility it may be mentioned that he is now also engaged in researches on a new system of navigation. The main idea is that at a very high speed the water will behave like a solid, and that it will require less power to skip, so to say, on the surface of the water than to plough through it. While this idea is already used to some extent in automobile boats, Dr. Héroult has devised special apparatus which very materially reduces the friction of the hull on the water.

But after all it is the man as a man that makes Dr. Héroult most attractive. His massive body gives an impression of immense latent energy, while in his direct and cordial manner he represents a most happy mixture of the best traits of the different nationalities among which he has lived. He speaks English and German as fluently as French and without any accent. In his courtesy and vivacity he is a typical Frenchman, while in his broad and well founded common sense in dealing with engineering problems he is like an American captain of industry.

There is one more point to be emphasized about Dr. Héroult as an engineer—that is his firm belief in the importance of theory. He once told the writer that wherever he was successful as an engineer, his success was based on previous theoretical analysis and calculation.

For ourselves we are glad to use this opportunity of acknowledging Dr. Héroult's friendship toward this journal from the very start. To our September issue, 1903, he contributed an article on his electric steel process—the only article he has ever written for an engineering journal; and in one of his characteristic letters he confessed that this was the first time that he had ever made a penny with his pen.

What Dr. Héroult has done has been cheerfully recognized, irrespective of national sentiment. When the Technische Hochschule of Aachen, Germany, opened in 1902 Prof. W. Borchers' new Institute for Metallurgy, Héroult received the honorary degree of doctor ingenieur. Last year France showed that republics are not always ungrateful to their own children, when Dr. Héroult was awarded the grand Lavoisier medal, which is granted every seven years to that French inventor whose work has exercised the greatest influence on the progress of French industries in the field of chemical arts.

In the metallurgy of aluminium, Dr. Héroult has made history. We have every reason to hope that he will be equally successful in the electrometallurgy of steel, and we may expect the earliest large developments in this country. While, for obvious reasons, it is impossible to state much that is going on in plants owned by corporations, we may say that the Canadian Government has appropriated the necessary funds for a large scale test at Sault Ste. Marie, while the Lake Superior Power Co. is to provide a building and free power for a limited period. These tests will be under the supervision of Dr. Eugene Haanel, Superintendent of Mines, Ottawa, Ont. Since these tests have to do not only with steel refining, but with the reduction of iron from ores in the electric furnace, their outcome is of very great interest, especially as Dr. Héroult will introduce several entirely novel schemes of his own, in order to utilize the electrical energy to the utmost possible limit.

However, industrial developments of apparently greater importance are soon to be expected in this country with respect to steel refining. In this field Dr. Héroult has with him the best wishes of all American electrochemists and electrometallurgists, besides the practical help of the Halcomb Steel Co., of Syracuse, N.Y., who have put up a plant for the production of 80 tons per day. This plant is to be started in about six weeks. Outside of the two old electric steel plants at La Praz and in Sweden, another large one, using the Héroult furnace, is being completed at Remscheid, in Germany, by the Electrostahl Co., formerly Richard Lindenberg Soehne, while the same process has now also been adopted by the Sault du Tarn Co., in France.

[Through the courtesy of Dr. E. F. Roeber, Editor of "Electrochemical and Metallurgical Industry," New York, we are able to reproduce the foregoing biography from that journal, and have pleasure in acknowledging the loan of the half-tone portrait, engraved recently from a signed photograph of Dr. Héroult.—Editor.]

THE ENGINEERS CLUB, TORONTO.

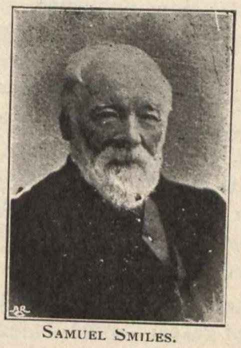
Opening of Session 1905-6.

The opening meeting of The Engineers Club was held on Thursday evening, September 28th, in the lecture room of the Society, King Street West, Toronto. The president of the club, R. F. Tate, occupied the chair. After the reading of minutes by Secretary Willis Chipman, it was decided to renew lease of present rooms. This was followed by electing to membership: Arthur W. Connor, C.E., and Edward B. Merrill; and by unanimous vote the privileges of the club were transferred to S. Groves, Editor The Canadian Engineer, and his assistant, Percy W. Ball. Then followed a conversation on the matter of papers to be read at the subsequent meetings of the club. The Papers Committee, Cecil B. Smith, F. L. Somerville, R. F. Tate, C. H. Rust, and W. Spry, were enjoined to get their programme ready straightway.

The topic for discussion was—"Toronto Island: its Improvement and Preservation," introduced by City Engineer, C. H. Rust, who pointed out on a large map the various changes in configuration, and coast line of the Island,—due to storms and encroachment of the waters of the lake—since it was disconnected from the main-land in 1853; indicated some of the measures taken from the civil engineer's standpoint for its preservation, and sketched possible ways in which this lovely marine resort can be beautified and otherwise improved in the future. Conversation on this perennially interesting theme, concluded auspiciously the first meeting of the current season.

Book Reviews.

Lives of the Engineers: Boulton and Watt. By Dr. Samuel Smiles. London: John Murray. 8" x 5½", 481 pp. (Price 3s. 6d., net.).



Samuel Smiles.

With the advent of autumn comes the time for quiet, indoor, solid reading. To the rising young Engineer a book like the handsomely bound, well printed, and charmingly illustrated volume before us should be an inspiration. Biography is the most precious of all reading. The story of James Watt, as told by Smiles, is more interesting than a romance. No wonder it has become a classic. The steam engine is the greatest invention of modern times, and every man, young or old, who takes a pride in the profession of Engineering ought to be acquainted with the life struggles of the greatest hero. Here is a passage worth reading:—

> Although the true inventor, like the true poet, is born, not made,—and, although Watt pursued his inventions because he found his highest pleasure in inventing,—yet his greatest achievements were accomplished by unremitting application and industry. He was a keen observer, and an incessant experimenter. "Observare" was the motto he deliberately adopted; and it expresses the principle and success of his life. He was always on the watch for facts, noting and comparing them. He took nothing for granted; and accepted no conclusions save on experimental evidence. "Nature can be conquered," he said, "if we but find out her weak side." His patience was inexhaustible. He was never baffled by failure, from which he declared that he learned more than from success. "It is a great thing," he once observed to Murdock, to find out what will *not* do: it leads to one finding out what *will* do."
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> "Give me facts," he once said to Boulton, "I am sick of theory; give me actual facts." Yet, indispensable though facts are, theory is scarcely less so in invention; and it was probably because Watt was a great theorist, that he was a great inventor. His invention of the separate condensor was itself the result of a theory, the soundness of which he proved by experiment. So with the composition of water, the theory of which he at once divined from the experiments of Priestley. He continued theorizing during the whole process of his invention of the steam engine. New theories presented new arrangements and the application of entirely new principles, until in course of time the engine of Newcomen became completely transformed.
>
> Watt's engine was not an invention merely—it might almost be called a creation. "The part which he played," says M. Bataille, "in the mechanical application of steam, can only be compared to that of Newton in astronomy, and of Shakespeare in poetry."

The Metallographist; now Iron and Steel Magazine. Vols. V., VI., VII., VIII., and IX. Edited by Albert Sauveur, Boston, U. S. A. The Boston Testing Laboratories. Size 9¼" x 6¼". ($3.50, each.).

These five strongly bound volumes represent high water mark in metallurgical research. The publisher evidently does not rely upon the cover to attract attention, for it is ascetically plain. But let the trained engineer, eager for foundation knowledge of the metals he uses, open the pages, and he will find paper and letter press work to suit the most fastidious taste, and illustrative engravings to delight the eye; while the essays, theses, and expository papers setting forth the latest researches of the microscope, chemical laboratory and testing chamber, as to the composition, physics, treatment and practical application of metals and their alloys are the product of the master minds of England, France, Germany, and the United States in metallurgical science: Sorby, Osmond, Stead, Roberts-Austin, Howe, Martens, Arnold, Andrews, Wedding, H. Le Chatelier, Ledeber, Behrens, Ewing, Charry, Tschernoff, etc. No engineer to-day is equipped for his work who is unacquainted with the verdicts of science on the metals and alloys of commerce. The six volumes of "The Metallographist" date back to 1898, and embody historically all that has been revealed by the microscope since Sorby published his classic paper in 1864, "On the Microscopical Photographs of Various Kinds of Iron and Steel." In 1904 the scope of the magazine was enlarged, and the jaw-breaking title changed to "Iron and Steel Magazine," and is now published in magazine form monthly at 50 cents per copy, or half-yearly volumes at $3.50. Here is what Professor Henry M. Howe, America's foremost metallurgist says about it:—"I cannot tell you how much delighted I am with 'The Metallographist,' it is a most precious publication. Hardly a day passes that I do not refer my students to it. I give more references to that, I think, than to all other publications together, and I found in Europe that this admirable work of yours was very highly appreciated." (Signed) Henry M. Howe.

In view of the coming renaissance in the iron and steel industries of Canada, the rich mine of research wealth contained within the covers of these volumes, should be explored by every enterprising engineer in the Dominion.

Modern Engines and Power Generators: a practical work on prime movers and the transmission of power—steam, Vols. I., II., III., IV., V. and VI. (1904). Toronto: The George Morang Company, Limited, publishers. Size 10½" x 8". (Price $18 per set of six vols).

"Blessed be drudgery," occurred to us when we first glanced at this imposing pile of tomes, but after careful reading of data on the well printed and copiously illustrated pages, our fears of *ennui* vanished, for we found a veritable feast of the good things which modern engineering has to show: presented with such precision and lucidity of statement, and manifest knowledge of both theory and practice, that even the way-faring man may read and understand. In making this last statement it must not be inferred that this work is in any sense a "primer," neither is it a mere catalogue or inventory, but it is written "in such a clear manner that any practical engineer can understand and construct the engines, boilers, etc., from the instructions given," and be able "to estimate in each case the costs of producing power under the different systems and circumstances."

We must congratulate the author on the wisdomic order in which he has divided his subjects. Had his mind been less objective in its outlook he would have commenced with Nero's engine, and treated us to a picturesque historical sketch, showing the evolution of the steam engine from Watt's epoch making invention of the reciprocating expansive, condensing engine, in 1698, up to Parsons' pressure, impulse turbine, in 1884. But with true grasp of the philosophy of teaching he commences with velocity and pressure turbines —which every alert up-to-date engineer ought to quickly become acquainted with, and then passes on to an exposition of the latest types of reciprocating engines, together with the transmission machinery, connecting the same with the work to be done. This is an altogether admirable arrangement, and adds considerably to the practical value of his work. In a subsequent number we shall deal critically with this valuable contribution to the science and art of practical engineering; but it will not be out of place at this time to set before our readers a summary of the general contents of the six volumes:—

Synopsis of contents.—The prime mover, a preliminary discussion—Its sources of energy; heat; electricity. The working substance in heat engines—Air; steam; water. The engines—Turbines—Air; water; steam; gas. Reciprocating engines—Single acting; double acting; compound, triple, and quadruple; horizontal, vertical. Engines rotary—Important parts of engines—Valves, and expansion gear; governors; condensors; pumps, air, and water; bearings and rod ends; lubricators. Generators—Steam boilers—Cylindrical; tubular; flash; water tube; economizers; superheaters; feed pumps; injectors; ejectors; water supply and coolers; care of, and mechanical stokers. Gas generators—Coal gas, and blast furnace gases—Water gas; mond gas; dowson gas. Oil fuels—Heavy oils; light oils; spirit, gasoline, benzoline, naphtha, and alcohol. Electric engines—Dynamos; batteries, generators, motors. Prime movers special, as made by leading engineers—For mills, factories, works, etc., on land—Turbines, steam, water, and air; reciprocating, steam, water, and air; for marine propulsion, steam, electric, water, and air. For motor cars—Steam, oil, electric. For railways and tramways—Power transmission and transmitting gearing, belts, ropes, wheels, compressed air, hydraulic pressure, electricity.

We have nothing but praise for this altogether admirable compendium of modern engineering practice.

Graphic Method of Structural Design. By William W. F. Pullen, Wh., Sc., M.E., C.E. Manchester, England: The Technical Publishing Company, Limited. Second edition (1905). Size, 7¼" x 5". (Price, 5s., net.).
We purpose reviewing this work in November.

Mechanics for Engineers: a text-book of intermediate standard. By Arthur Morley, M.Sc., university scholar (Vict.). London: Longmans, Green & Company (June, 1905). Size, 7½" x 5¼". (Price, 4s., net.).

An able writer in the editorial columns of "Engineering News," August 31, 1905, makes a strong plea that mathematics for engineering students should be taught by engineers. Here are some of the wise things said:—

From the frequency with which erroneous solutions of engineering problems come to this office, we infer that many engineering graduates have had too much pure mathematics and too little applied mathematics. Errors of mathematical logic are far more common than errors in mathematical processes. Students have learned how to integrate without having learned how to "set up" a problem correctly. Now, it is apparent that under proper instruction in applied mathematics, so large a number of engineering problems should be given that the student would enter his course in higher mechanics with a good fundamental knowledge of mathematical logic, and upon finishing his mechanics (including hydraulics) he would be a master of mathematical logic, and not a mere memorizer.

In passing, 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.

Returning to our main theme: If it is conceded that mathematics should be taught to engineers as an applied science, then it follows, as our first corollary, that every part of the mathematics which is likely not to be applied in practice should be struck out of the course. In a word, nothing should be left simply because it furnishes "mental training." We now see why it is that text books on mathematics for engineers should be written by engineers.

Our second corollary is that duplicate demonstrations of formulas should be avoided. Any one who will take the pains to compare calculus demonstrations with those in analytical geometry will find an unexpectedly large amount of this duplication. As a rule, too, he will find that the calculus could have been substituted for analytical geometry to advantage. One of the speakers at the convention above referred to, urged the desirability of teaching calculus and analytical geometry at the same time and from the same book. This, we believe, is a step in the right direction, for it would lead to a clearer comprehension of the principles of higher mathematics, and would give more time for the "soaking in" process, so that calculus and analytical geometry would both be used with greater facility in solving problems.

It is now conceded that mathematics is best learned by solving problems. The problems should be largely of a practical nature and of a kind that the engineer is likely to meet later in life. Problems in mechanics may be introduced in the regular mathematical courses, and, in fact, the student would thus find himself possessed of a good grasp of the fundamental principles of mechanics before taking up the courses devoted to that by name.

The work before us embodies almost ideally the view enunciated above. One feature is that the author has "cut out" the confusing "poundal" as the unit of force, and has exclusively adopted the rational gravitational system. Graphics are not unduly prominent; the analytical method applied in a wise selection of practical problems, prevailing througnout the course. It is the best treatise we have seen on mathematics as applied to the working out of practical problems in mechanics; and engineering students will make no mistake in securing a copy at the earliest possible date.

INDUSTRIAL NOTES.

The Brantford Screw Co. proposes to double the size of their factory.

McLean, Holt & Co. propose erecting a $10,000 stove foundry in St. John, N.B.

The Brantford Electric & Operating Company are installing a new steam plant.

The electric lighting plant at Chatham, Ont., will be enlarged at a cost of $35,000.

The Record Foundry Co., St. John, N.B., will establish a branch foundry in Vancouver, B.C.

A 50,000-bushel elevator is to be built by the Medicine Hat Milling Company, Medicine Hat, N.W.T.

Plans have been prepared for the construction of a breakwater at Port Arthur, Ont., at a cost of $250,000.

The new plant of the Dominion Iron & Steel Co., Wabana, Belle Isle, Newfoundland, has been completed.

A water and sewerage system will be established at Banff, by the Dominion Goevrnment, at a cost of $95,000.

The Goderich Elevator Company, Goderich, Ont., have awarded the contract for a cement and steel elevator of half a million capacity to J. H. Fromanhausen, of Minneapolis. The cost will be $140,000.

Contracts have been let for the construction of buildings for the new sheet steel and tin plate mills at Morrisburg, Ont.

The Canadian Fairbanks Co., Montreal, is installing a 40-h.p. Fairbanks-Morse Gasoline Engine in the factory of the Boston Last Co., Richmond, Que.

Two employees of the Dominion Bridge Co. were killed and one fatally injured by the giving way of a scaffold at the new Roman Catholic Church at St. Cunegonde, Que.

The reported serious leakage in the cement work of the new lift lock at Kirkfield, on the Trent Canal, has, inquiry at the office of the superintendent shows, been repaired at a cost of $200.

The Fraser River Tannery Company, New Westminster, B.C., will erect three buildings, the largest of which will be 100 by 150 feet, three stories high. The machinery will cost about $10,000.

The buildings of the St. Lawrence Iron Works, St Catherine Street, Montreal, were visited by fire, which did damage to the extent of $7,000 partially covered by insurance. The plant will be rebuilt.

The B. F. Sturtevant Co. announce the removal of their plant from Jamaica Plain to Hyde Park, Mass. The new works has a floor space of nine acres, and is equipped with the most modern appliances.

The Fairbanks Company, of Chicago, have completed arrangements to build a Canadian Duplicate of their Chicago factory in Toronto, and have purchased eight acres of land situated on Bloor Street West, for the purpose. The company employ about 1,000 hands.

Several of the buildings of the Canada Machinery Co., at Point Edward, Ont., were destroyed recently by fire. The total loss will be $140,000 partially covered by insurance. Some of the workmen lost valuable tools in the fire. The company employed about 90 men.

The Canada Foundry Co., Limited, has recently closed a contract with the Western Fuel Co., of Nanaimo, for two seventy-two inch diameter by eighteen feet long, a hundred and fifty horse-power horizontal tubular boilers, working pressure a hundred and twenty-five pounds per square inch.

The car shops in Kingston, containing much valuable machinery, were destroyed by fire. The loss is estimated at $50,000.

The Imperial Steel & Wire Company, Collingwood, Ont., will erect additions to their factory to cost about $100,000.

The Lehigh Portland Cement Company, of New York City, have arranged to establish at Belleville, Ont., a branch factory with a capacity of 2,500 barrels a day.

In order to establish a branch stove foundry at Vancouver, the Record Stove Foundry, of Moncton, N.B., proposes to increase its capitalization from $800,000 to $1,000,000.

The Canadian Fairbanks Company, Limited, Vancouver, B.C., recently shipped a complete machine shop equipment, consisting of power steam hammers, punch and shear lathes, drill presses, and full equipment of small tools to the Fiji Island.

The plant of the Alexander Brown Milling and Elevator Company, Toronto, was recently destroyed by a disastrous fire, in which Capt. Sargent Thos. Worrell of the fire brigade was killed. The loss which is covered by insurance, is estimated at $160,000.

The corporation of St. Marys, Ont., is putting in a 150 kilowatt generator of the revolving fired type. They are also making changes in the street lighting system. Contracts will be closed the week of October 2nd. Specifications may be seen at the office of K. L. Aitken, consulting engineer, 164 Bay Street, Toronto.

The Canadian Fairbanks Company recently closed a deal with Lumsden & Van Stone Company, contractors of Boston, to furnish all supplies necessary for equipping the new chocolate plant of the Walter M. Lowney Company, Montreal. They have also recently completed an order for the Canada Car Company for Fairbanks' valves, covering the entire equipment.

Guelph city council has made arrangements with the Roberts Manufacturing Company for the installation of a filtration plant at a cost of $12,500. The council is to provide the buildings and other necessary construction and piping. The company engages to supply water which will stand all the chemical and bacteriological tests for purity. The total cost will be about $20,000.

The ratepayers of Meaford, Ont., have adopted two by-laws, one authorizing the expenditure of $7,500 for the purchase of an electric light plant to pay W. Moore & Sons $4,400 per year for supplying electric power to operate the same in connection with the waterworks; the other to raise by way of loan $5,000 for the purchase of an 80,000-gallon storage tank for the waterworks.

The Keewatin Flour Milling Co. has recently closed a contract with the Allis-Chalmers Co., of Milwaukee, for the machinery of one of the largest flour mills on the continent. The amount involved will be about $225,000. The mill building, now under construction, will be completed by the 1st of January, and the equipment will be equal to about 40,000 barrels per day. A number of Ottawa capitalists are interested.

The Canadian Steam Boiler Equipment Co., Ltd., Toronto, makers of the cyclone shaking and dumping grate, inform us that within the past few weeks they have made the following installations: The Dale Estate, Brampton, Ont., 15 sets; Jennings Co., Brampton, 5 sets; J. E. Seagram Co., of Waterloo, the entire plant. They have also placed these grates on the plants of the Ontario Sugar Co., Berlin, Ont., and the Brampton, Ont., Milling Co.

The Dominion Natural Gas Company, represented by President J. C. McDowell and F. M. Lowry, of Pittsburg, Pa., state that by an agreement signed and delivered, their company will come into control of the Galt Gaslight Company's gas plant on October 1st. The Dominion people have leased the Galt plant, and so soon as the mains are laid to the town, about November 1st, perhaps earlier, will supply consumers in Galt at 35 cents per thousand. The natural product from the Selkirk field will be used.

The works of the Canada Saw Works at Ottawa have been closed, and the plant and machinery will be removed to Montreal.

The contract for dredging the harbor of St. John, N.B., has been awarded to G. S. Mayes. An appropriation of $100,000 was voted by Parliament for this work.

The Imperial Cement Co., Montreal, P.Q., is equipping itself with a Sturtevant pulverized coal burning apparatus, supplied by the B. F. Sturtevant Co., of Boston, Mass.

Patrick Kennedy and L. B. Lachance, of Ottawa, have been awarded the contract to construct a breakwater at St. Peter's, P.E.I., the contract price being about $12,000.

The J. I. Case Threshing Machine Company, which owns and operates one of the largest agricultural manufacturing plants in the world at Racine, Wis., is about to build a factory near Winnipeg, Man., that is expected to rival the plant already running in the United States.

The Westinghouse interests have bought a site on the Niagara frontier, on which they will build a great plant for the manufacture of electrical machinery. The site selected is on the Niagara Gorge, below Niagara Falls.

The Canadian Westinghouse Co., of Montreal, has been awarded the contract for the installation of a 1,500-k.w. steam turbine for the Ottawa Electric Co. The turbine will be the largest placed by the company in Canada.

The Niles, Bement, Pond Company, builders of machine tools, of Hamilton, Ohio, have bought out the business and plant of the John Bertram & Sons Co., Limited, Dundas, Ont., and will manufacture for Canadian consumption on Canadian Soil.

The Canadian Fairbanks Co.. Limited, Montreal, have been awarded the contract for the power transmission appliances, including Fairbanks' wood split pulleys and universal giant hangers for the new factory of the Gananoque Bolt and Nut Works.

The Canada Launch and Engine Works, Limited, Toronto, have decided to go into liquidation. The immediate cause of the trouble is a lack of ready means to continue the business which was begun by this firm some eighteen years ago. It has manufactured nearly every description of launch.

The demand for mica covering in England has increased so much that the Mica Boiler Covering Company, of Montreal, has established a factory at Widnes, Lancashire, where it is now manufacturing these coverings. At the present time it has contracts on hand there for the insulation of several battleships, electric plants, etc. Mica covering was only adopted by the British Admiralty after exhaustive tests had been made of it with a number of other coverings, from all over the world.

The contracts for the Regina waterworks and sewage extensions have been let to Messrs. Dobson, Jackson & Fry. The contract provides for the putting down of 11,400 feet of water mains, and the same amount of sewage extensions, the contract price being $23,400. The contract for the supply of the pipes required for the extensions has been awarded to the Canadian Pipe Company, of Vancouver, who have also secured the contract for valves, hydrants and valve boxes, the value of the company's contract being $6,600.

The Lehigh Portland Cement Co. recently purchased about 1,000 acres of limestone and clay lands, preparatory to the erection of one of the largest single cement plants in the world; to have a capacity of 4,000 barrels per day. To the Canadian contractors and consumers, the entry of this company into Canada means a great deal, as it can now supply the Canadian market to the fullest extent called for. Dealers and contractors wishing prices for the "Lehigh" Portland cement should address the Thorn Cement Co., Buffalo, N.Y.

If ever there was a time when young Canadians with energy and character could feel confident when starting out for themselves it is now. It would seem as though it were well nigh impossible for a man or firm to fail if they exercise good judgment and pay due regard to the laws of good business. In this connection we have pleasure in referring to the establishment of the new firm of Gentle & Traves, dealers in steam specialties, 23 Scott St., Toronto. Both these gentlemen have had practical experience, and are, therefore, fully capable of giving an intelligent service to their customers. They have secured a very good line, including the Crandall packing, Anderson steam traps, Dunham expansion traps, and several other specialties. This young firm starts out under auspicious circumstances and we wish them complete success.

RAILWAY NOTES.

The net earnings of the Temiskaming Railway in August were over $13,000.

A new railway station is to be built at Charlottetown, P.E.I., for the I.C.R.

An engine house is to be erected at Pictou, N.S., by the Intercolonial Railway.

Plans are being prepared for the construction of a large machine shop for the Grand Trunk at Mimico.

The Great Northern Railway will build a large depot at Fernie, B.C., to replace the one destroyed by fire.

The car barns of the Mimico branch of the York Radial Railway were destroyed by lightning, the loss being $17,000.

Plans are under way for the erection of buildings for the construction and repair of cars for the I.C.R., at Moncton.

The Calgary Street Railway Company, Calgary, has asked for permission to proceed with the construction of an electric street railway.

The Grand Trunk Railway Company, are considering the erection of a large depot, a new freight house, and an overhead bridge in London, Ont., to cost about $2,000,000.

Hon. Mr. Emmerson has been authorized by the Government to purchase forty new locomotives for the Intercolonial Railway. The understanding is that they are to be purchased from Canadian firms.

The C.N.R. has let the contract for a $40,000 station at Port Arthur. Five new stations are also to be built between Rainy River and Port Arthur. It is said one of these new stations will be built at LaValle, and the other four east of Atikokan.

The double tracking of the I.C.R. necessitates the building of a new bridge over the Sackville River at Bedford, N.B., and construction is now well under way. The construction is being done by F. A. Rounan & Co., St. John, and the steel part by the Dominion Bridge Works.

On September 11th, Sir Wilfrid Laurier turned the first sod of the Grand Trunk Pacific Railway in the west limits of Fort William. In June, 1875, a similar ceremony took place within a few yards of the recent one, when the first sod of the Canadian Pacific Railway was turned.

The town of Galt has at last agreed to permit the Grand Valley Railway Co. to lay rails on the streets of the town, and thus to connect with the G. H. & P. Railway. Up to the present time the Grand Valley have been running their cars to the corporation limits, and connecting with the G. H. & P. by bus.

Contractors Edge and Gutteridge, of Seaforth, have been awarded the contract for thirteen stations on the Guelph and Goderich branch of the C.P.R, These do not include Goderich or Guelph stations. The work will begin at once at Milverton and follow toward Goderich. The total cost of the thirteen stations will be about $35,000.

It is said that the Vanderbilts have practically determined to tunnel the Niagara River for the purpose of securing a quicker transit of traffic to and from the west through Canada. Civil engineers representing the Michigan Central Railway are now looking over the ground between Buffalo and Niagara Falls, with a view of ascertaining the best locality to construct the tunnel.

The C. P. R. has just issued one of the largest orders for rolling stock ever given by any railway. It is for cars only, and calls for an expenditure of $3,000,000. The order is for twenty-five parlor, sleeping and dining cars, ninety passenger coaches of different classes, and 3,000 freight cars of all descriptions. These cars will be built at the company's Angus shops at Montreal, Que.

MARINE NEWS.

The steel work on the new bridge at Ferry Point, N.W.T., is now completed.

The Canada Atlantic Railway has taken an action for $10,000 against the owners of the barge Nicaragua for smashing into the company's bridge across the Soulanges Canal.

The B. C. Marine Railway Company, of Esquimalt, are building the new C. P. R. steamship for the Victoria and Skagway route. The plans call for a ship almost a duplicate of the steamship Princess Victoria.

The storm which prevailed on Lake Superior one evening recently did $5,000 worth of damage to the coal and ore docks at Port Arthur, owing to the fact that the breakwater does not protect the shore at this point.

The propeller "Melbourne," of Hamilton, was burned to the water's edge at the east end of Murray Canal, near Trenton, last month, and is totally wrecked. The Melbourne is a regular canal propeller, the property of Jacques & Company, of Montreal, and is valued at $30,000. The insurance is not known.

The Canadian Shipbuilding Company, Limited, have launched the steel tug which they are building for the Great Lakes Dredging Company, of Port Arthur. This tug, which is one of the largest in the Dominion, has been specially built for ice breaking, and will be used in keeping the Port Arthur harbor open for navigation during the winter months, in addition to its regular work in connection with the dredging of the harbor.

MINING MATTERS.

A deposit of coal has been discovered near Okanagan Lake, B.C.

It is proposed to erect a smelter at Princeton, in the Similkameen district, British Columbia.

Fire did about $100,000 damage to the wash plant of the Dominion Coal Co., near Port Morien, N.S.

A vein four feet wide, averaging 3,000 ounces silver to the ton, was struck on the Ottawa mine near Slocan City.

A crusher is to be erected at Copper Cliff, the smelting town of the Canadian Copper Co., for the reduction of Cobalt ore.

The Dominion Government has appointed experts to investigate the character and extent of the zinc deposits in British Columbia.

At Grand Forks, B.C., a by-law has been introduced, which provides for the bonusing of the Dominion Copper Company in the event of their erecting their smelter at that place. It is understood that the amount will be in the neighborhood of $30,000.

An order-in-council has been passed abolishing the royalty upon Yukon gold claims in which $25,000 has been spent within five years. An order has also been passed abolishing royalty on copper claims on which $50,000 has been spent within ten years. Both are effective for ten years.

R. E. Harris, president of the Nova Scotia Steel Company, completed an important deal in Newfoundland recently, when he purchased from the local owners the submarine ore areas on the north of Belle Isle. The ore deposits on the island are beginning to run short, and from present appearances it looks as if the supply will last but a few years longer.

The Granby Consolidated has concluded the purchase of the Gold Drop group of claims in Phoenix Camp, B.C., for $250,000. The property has been under bonds for months, and has been exhaustively tested. The property is owned by the Diamond Drill Company, of Montreal, who spent $40,000 in developing and equipment.

The Western Canada Cement & Coal Co., London, England, has authorized applications for £2,250,000 of first mortgage bonds at par to be supplied in acquiring cement, clay and anthracite coal lands at Kananaskas, Alberta, in erecting a portland cement factory, and for working capital. Besides this is contemplated the building of 300 to 500 elevators throughout the North-West, equipped with the latest appliances, and with a capital of from ten to twelve million dollars.

LIGHT, HEAT, POWER, ETC.

The electric light plant of Parry Sound, Ont., will be enlarged.

The town council of Newmarket, Ont., is considering the installation of an electric lighting plant.

Vernon, B.C., will borrow $12,000 for improvements to the electric lighting plant.

The town council of Chatham, N.B., is taking steps to improve the electric light plant, at a cost of $35,000.

The ratepayers of Edmonton, Alta., will vote on a by-law to raise $15,000 for improvements to the electric lighting plant.

The Custodis Chimney Construction Company will build a chimney for the Westmount, Que., electric light plant, 150 feet high and 6 feet in diameter at the top, at a cost of $6,250.

The Western Electric Co. proposes to erect a factory 50 x 200 feet at Waterloo, if the town guarantees their bonds for $16,000 for twenty years. Electric meters and trunk finishings will be manufactured.

The tender of the Robb Engineering Company, amounting to $8,300, for engines, accessories and their erection in connection with the new electric light plant at Westmount, Que., was accepted, a satisfactory guarantee having been given.

Allis-Chalmers-Bullock Co., Limited, Montreal, have been awarded the contract for the electrical and hydraulic machinery for the city of Nelson power plant on the Kootenay River, B.C. The amount of the tender for the electrical machinery was $29,985, and $13,600 for the hydraulic.

The work of developing power at the Kaministiqua Falls, near Port Arthur, will be proceeded with as rapidly as possible, it is announced. The company, which is about to undertake the development, has let contracts to the Canadian General Electric Company for the generators, exciters, switch-boards, etc., the total cost being, it is understood, in the neighborhood of $200,000.

PERSONAL.

C. A. Cambridge, Winnipeg, Man., was elected fourth vice-president at the recent international convention of municipal electricians, held at Erie, Pa.

After October 1st, Wm. Boland, for six years the genial business agent for the Toronto Branch of the International Association of Machinists, will look after the city trade of the Economical Supply Co., Toronto. It is in good hands.

Frank Alfred, chief engineer of the Pere Marquette Railway, has resigned to accept an important position with the Canadian White Company, the Canadian branch of the contracting firm of J. G. White & Company, New York, and London, Eng. Mr. Alfred will have his headquarters in Montreal.

MUNICIPAL WORKS, ETC.

The town of Midland, Ont., will spend $10,000 to build cement sidewalks.

The financial report for the past eleven months, during which Kingston has owned its gas and electric plant, shows that the net profit for that time is $11,192.

Medicine Hat has just struck another big gas gusher, and the municipality is selling natural gas at 5 cents per thousand feet to manufacturers.

The town of Port Hope is considering the proposition of installing a municipal lighting plant for street lighting purposes. Electricity will be generated by water-power.

Engineer Archibald has submitted to the town council of Neepawa, Man., a plan of the proposed White Mud River water-power development, which is estimated to cost $40,000.

At Woodstock, the by-law voting $50,000 for improvements to the waterworks and electric plant carried with a large majority. The improvement includes the building of a large reservoir to the south-west of the city.

TELEGRAPH AND TELEPHONE

The Bell Telephone Company announce that they will erect a new $40,000 office in Brantford, install a central energy system there, and lay further underground cables.

The Newfoundland Government having completed the laying of a cable from Canso, N.S., to Port au Basque, Newfoundland, connecting with all inland lines on the island, the Canadian Pacific Railway Company's telegraph secures direct connection with all parts of the island.

The independent telephone line between Bancroft, Coehill, Madoc, Eldorado and Marmora, Ontario, has been sold to the Bell Telephone Co.

In 1912 Great Britain will purchase the plant of the National Telephone Co., which has a capital of over $45,000,000, and run it on municipal lines.

NUGGETS FROM OTHER MINES.

The ad. that makes the reader think is the ad. that hits home.

The right pictures and the proper words will work wonders when they join forces in an advertisement.

The long arm of good advertising will reach the trade that's needed to make your business grow.

TOO BAD HE WAS NOT THE LAST.

William Haskinson, a minister of the cabinet, was the first man killed by a locomotive.

He was killed by Stephenson's "Rocket" at the opening of the Liverpool and Manchester Railroad. This engine won $2,500 at the famous Rainhill contest.

NEW INCORPORATIONS.

Ontario.—The Cataract Electric Co., Orangeville, $50,000; J. M. Deagle, L. B. Code, E. M. Deagle, Caledon; J. L. Island, Orangeville; F. Deagle, Tp. Artemesia.

Port Arthur Iron Mines, Toronto, $500,000; W. H. Moore, G. G. Ruel, F. C. Annesley, L. W. Mitchell, J. Barbour, Toronto.

The Detroit and Kent County Oil and Gas Co., of Ontario, incorporated under the laws of Arizona, United States, has been granted a license to operate in Ontario. Attorney, W. Jackson, Osborne, Ont.

The Kerlin Bros. Co., incorporated under the laws of Ohio, U.S., has been granted a license in Ontario to carry on business as contractors for electric light, electric street railway plants, etc. Attorney, H. E. Rose, Toronto.

The Dymond and Abitibi Mining and Development Co., New Liskeard, $25,000; J. Wilson, J. McCracken, J. Mason, C. A. Marwahn, J. Scott, W. J. Tindall, W. J. Evans, New Liskeard.

The Buffalo Mining Co., Fort Erie, $50,000; C. L. Denison, R. W. Pomery, G. C. Miller, Buffalo, N.Y.; G. W. Mason, H. S. White, Toronto.

Economic Power, Light and Heat Supply Co., Toronto, $50,000; J. J. Palmer, J. C. Palmer, H. N. Baird, E. T. Malone, and A. L. Malone, Toronto. To deal in machines, engines, dynamos, motors, etc.

The Copper Mining and Smelting Company, of Ontario, Bruce Mines, $1,000,000; T. H. Sheen, H. J. C. Williams, London, Eng.; F. M. Perry, R. A. Lyon, Toronto; J. A. McPhail, Sault Ste. Marie.

The Sucker Creek Gas and Oil Co., of Anderson, Amherstburg, $250,000; J. G. Mullen, W. H. McEvoy, J. A. Auld, H. Clay, Amherstburg; H. G. Duff, W. H. Gatfield, Anderson Township, and others.

The New Ontario Cobalt and Silver Mining Co., Ottawa, $1,000,000; W. G. White, W. A. Allan, J. R. Lewis, Ottawa; J. C. Orr, New York; Hon. L. Bedell, Goshen, N.Y.

The Temiscamingue Mining Co., Haileybury, $100,000; C. A. Richardson, St. Catharines; J. L. Wheeler, Emporium, Pa.; R. A. Cartwright, New York; J. F. Gillies, Haileybury.

The Toronto Launch and Engine Co., Toronto, $40,000; J. C. McLachlan, J. G. Robinson, G. E. Buck, R. G. Copeland, and G. W. Hambly, Toronto.

The Canadian Towing and Wrecking Co., Port Arthur, $100,000; J. Murphy, J. T. Horne, Fort William; C. M. Bowman, Southampton; J. Walen and A. J. McComber, Port Arthuh. To carry on business as a general dredging, towing, wrecking and salvage company.

The Loughborough Mining Co., Sydenham, $10,000; M. F. Westover, E. Clark, D. M. Barton, A. H. Jackson, Schenectady, N.Y., and G. W. McNaughton, Sydenham, Ontario.

The London Pressed Stone and Concrete Co., London, $40,000; J. Nicholson, J. C. Judd, E. A. Shoebotham, H. F. Whetter and T. C. Knott, London.

The Plumbing and Heating Supply Co., Toronto, $100,000; F. Armstrong, W. Mansell, D. Fasken, A. T. Struthers and G. A. McCann, Toronto. To carry on a general plumbing, steam fitting and heating business.

The Bethesda and Stouffville Telephone Co., Stouffville, $40,000; A. D. Bruce, M. Forester, G. Forester, Markham Tp.; G. A. Brodie, Whitchurch Tp.; J. H. Ratcliff, R. Miller, F. A. Dales, D. W. Heise, Stouffville. To carry on a telephone business in the townships of Markham, Whitchurch, King, Pickering and Uxbridge.

The Dominion Natural Gas Co. has increased its capital from $500,000 to $1,000,000.

The Ottawa Cement Block Co., incorporated under the laws of the Dominion Parliament, have been granted a charter by the Ontario Parliament also. L. S. Macoun, Ottawa, has been appointed attorney.

Coleman Cobalt Mining Co., Toronto, $250,000; A. R. Moore, R. M. Copeland, R. Falconer, H. B. Wills, J. Jennings, R. Marshall, Toronto.

The Canadian Tool Co., Ltd., Woodstock, $100,000; E. G. Law, J. Stickney, Toronto; A. J. Downing, J. J. Terry, and T. L. Wilson, Woodstock. To manufacture machinery, engines, etc.

The name of the Walter Nicholls Motor Boat Co. has been changed to Nicholls Bros., Ltd.

The Canada Brass Rolling Mills Co. has increased its capital from $150,000 to $500,000.

The Savage Cobalt Silver Mining Co., Toronto, $250,000; C. A. Matsen, J. R. L. Starr, J. H. Spence, A. A. Rogers A. M. Duncan, Toronto.

Ontario Smelters, Ltd., Toronto, $500,000; T. H. Smallman, London; S. F. Kirkpatrick, Kingston; G. E. Drummond. Montreal; A. Fraser, Niagara Falls, and W. Southam. Hamilton. To carry on business as a milling, mining, and development company.

The Vermont Farm Machine Co., incorporated in the State of Vermont, has been granted permission to operate in Ontario, provided that in doing so it does not use more capital than the sum of $25,000.

E. C. Atkins & Co., incorporated in Indiana, has been granted permission to operate in Ontario to manufacture and deal in machinery, tools, hardware, etc., provided that in so doing the company does not use more than $40,000 capital, C. D. Ten Eyck, Toronto, attorney.

Dominion.—North River Power Co., Montreal, $90,000; E. Bikerdike, A. Fogarty, J. A. Stavely, Montreal; and H. W. Robertson, St. Andrews.

The Mouterde's Electric Accumulator Co., Montreal, $250,000; F. Mouterde, J. G. Ryan, New York; J. S. Visger, Denver, Col.; E. Lepage, A. Moisan, O. Hebert, J. C. Lamothe, Montreal.

Manitoba.—"Builders" Equipment Co., Winnipeg, $120,000; A. Macaw, A. R. Bredin, L. C. Hazlett, J. A. Tanner, and W. J. Cummings, Winnipeg. To manufacture all kinds of machinery, including cement, block, etc.

The Jones & Moore Electric Co., Winnipeg, $75,000; J. W. Jones, Toronto; G. H. Hicks, L. M. Delbridge, J. C. Kavanagh, C. W. Bradshaw, Winnipeg. To carry on business as electrical and mechanical engineers.

Quebec.—St. Lawrence Supply Co., Montreal, $20,000; W. A. McKay, J. G. Veith, A. R. Oughtred, M. A. Phelan, Montreal, and E. G. Place, Westmount. To carry on business as machinists and engineers.

British Columbia.—The Alaska Pumice Stone Hydraulic Cement and Trading Co., $50,000.

The Southern Okanagan Power Co., $50,000.

The Albion Stove Works, $30,000. To carry on business as iron-founders, tool-makers, machinists, etc.

Green City Gold Mining, Smelting and Development Co., $1,500,000.

St. Lawrence Supply Co., Montreal, $20,000; W. A. McKay, J. G. Veith, A. R. Oughtred, M. A. Phelan, Montreal, and E. G. Place, Westmount. To carry on business as machinists and engineers.

NEW CATALOGUES.

WATER-TUBE BOILERS.

Canada Foundry Company, Limited, Toronto, Ont.—Bulletin No. 32 graphically describes and illustrates the "Canada Water-tube Boiler," as manufactured by this company, 8 x 10 1-2, pp. 15.

WATER PURIFICATION.

"Worth Knowing" is the title of a comprehensive treatise on water purification, embodying facts and figures of practical value to steam users, issued by the Keystone Chemical Manufacturing Company, Philadelphia, Pa., U.S.A. The Canadian Oil Company, Limited, Toronto, Ont., are sole agents for Canada. 5 x 6 3-4, pp. 61.

FLANGED PIPE JOINTS.

Crane Company, Chicago, Ill., U.S.A.—Circular No. 9 CWJ: an illustrated description of Craneweld flanged pipe joints. 6 3-4 x 10 1-4, pp. 8.

STEAM SPECIALTIES.

Sheldon & Sheldon, Galt, Ont.—A very neat little booklet setting forth the advantages of their steam specialties, together with price lists. 3 1-2 x 6, pp. 12.

REGULATING AND REVERSING CONTROLLERS.

The Canadian Westinghouse Company, Limited, Hamilton, Ont.—Circular No. 1108 lucidly describes and aptly illustrates Westinghouse Regulating and Reversing Controllers. 7 x 10, pp. 23.

GRAPHITE.

The Joseph Dixon Crucible Company, Jersey City, N.J., U.S.A.—"Graphite" is the title of a lively monthly publication in the interest of users of Graphite, and contains useful information thereon. 9 x 12, pp. 12.

STEEL SHEET PILING.

United States Steel Piling Company, 135 Adam Street, Chicago, Ill., U.S.A.—A well illustrated booklet, descriptive of sheet steel piling. 4 3-4 x 7 1-4, pp. 12.

TAPS.

Wells Bros. Company, Greenfield, Mass., U.S.A.—A price list of "Little Giant" Taps of all sizes, with elaborate illustrations. 5 x 7, pp. 37.

RAILWAY MOTORS.

Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., U.S.A.—The Westinghouse No. 113 Railway Motor, for direct-current service, is completely described and illustrated in circular No. 1120. 7 x 10, pp. 15.

MEASURING AND MIXING MACHINES.

The Link-Belt Engineering Company, Philadelphia, Pa., U.S.A., publish a very fine catalogue, showing the advantages of their Trump Concrete Measuring and Mixing Machine. 6 x 9, pp. 29.

MANILA ROPE.

C. W. Hunt Company, No. 45 Broadway, New York, N.Y., U.S.A.—Pamphlet No. 059 is descriptive of their line of Pulley Ropes, etc. 6 3-4 x 5 1-2, pp. 8.

AIR COMPRESSORS.

Laidlaw-Dunn-Gordon Company, Cincinnati, Ohio, U.S.A.—Their improved Cincinnati Air Compressor is described in bulletin L. 508. 6 x 9, pp. 35.

HYDRAULIC AND POWER SCREW PRESSES.

William R. Perrin & Company, Limited, Toronto, Canada.—Catalogue No. 10 sets forth in detail the various Presses manufactured by this company. 9 3-4 x 6 3-4, pp. 35.

TRAVELLING HOISTS AND TROLLEYS.

Niles-Bement-Pond Company, New York, N.Y., U.S.A.—An artistically printed catalogue, with a wealth of illustration, showing their travelling hoists and trolleys in operation. 12 x 9 1-4, pp. 23.

PNEUMATIC APPLIANCES.

The Consolidated Pneumatic Tool Company, Limited, No. 9 Bridge Street, Westminster, S.W., England.—Circular No. 11 brings to notice the many awards received by this Company for Pneumatic Appliances. 7 x 9 1-2, pp. 4.

OIL PUMPS.

The Lunkenheimer Company, Cincinnati, Ohio, U.S.A., have published a neat little pamphlet, citing testimonials received from users of their Mechanical Oil Pumps. 6 x 3 1-2, pp. 23.

PREPAYMENT WATTMETERS.

Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.—These Wattmeters are well described and illustrated in circular No. 1123. 7 x 10, pp. 8.

AIR BRAKE EQUIPMENTS.

National Electric Company, Milwaukee, Wis., U.S.A.—Bulletin No. 357, a handsomely printed pamphlet, illustrating their "Christensen" Air Brake system. 7 x 10, pp. 12.

GENERATORS.

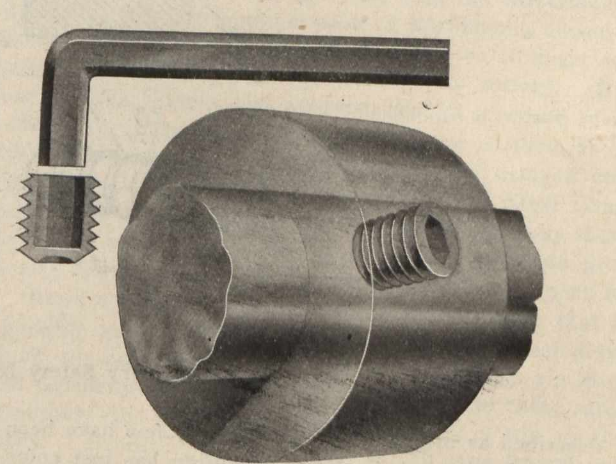
National Electric Company, Milwaukee, Wis., U.S.A.—The belt driven Generators manufactured by this Company are admirably pictured and described in Bulletin No. 355. 7 x 10, pp. 12.

RAILWAY APPARATUS.

Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., U.S.A.—A beautifully illustrated catalogue, descriptive of railway appliances. 6 1-4 x 9 1-4, pp. 20.

A NEW SET SCREW.

As an outlook committee for gathering new ideas, we make no apologies for introducing to our readers the excellent device illustrated below.



Life Saving Set Screw
With Hexagon Hole and Wrench.
Sides 3/8", 1/2", 5/8", 3/4".

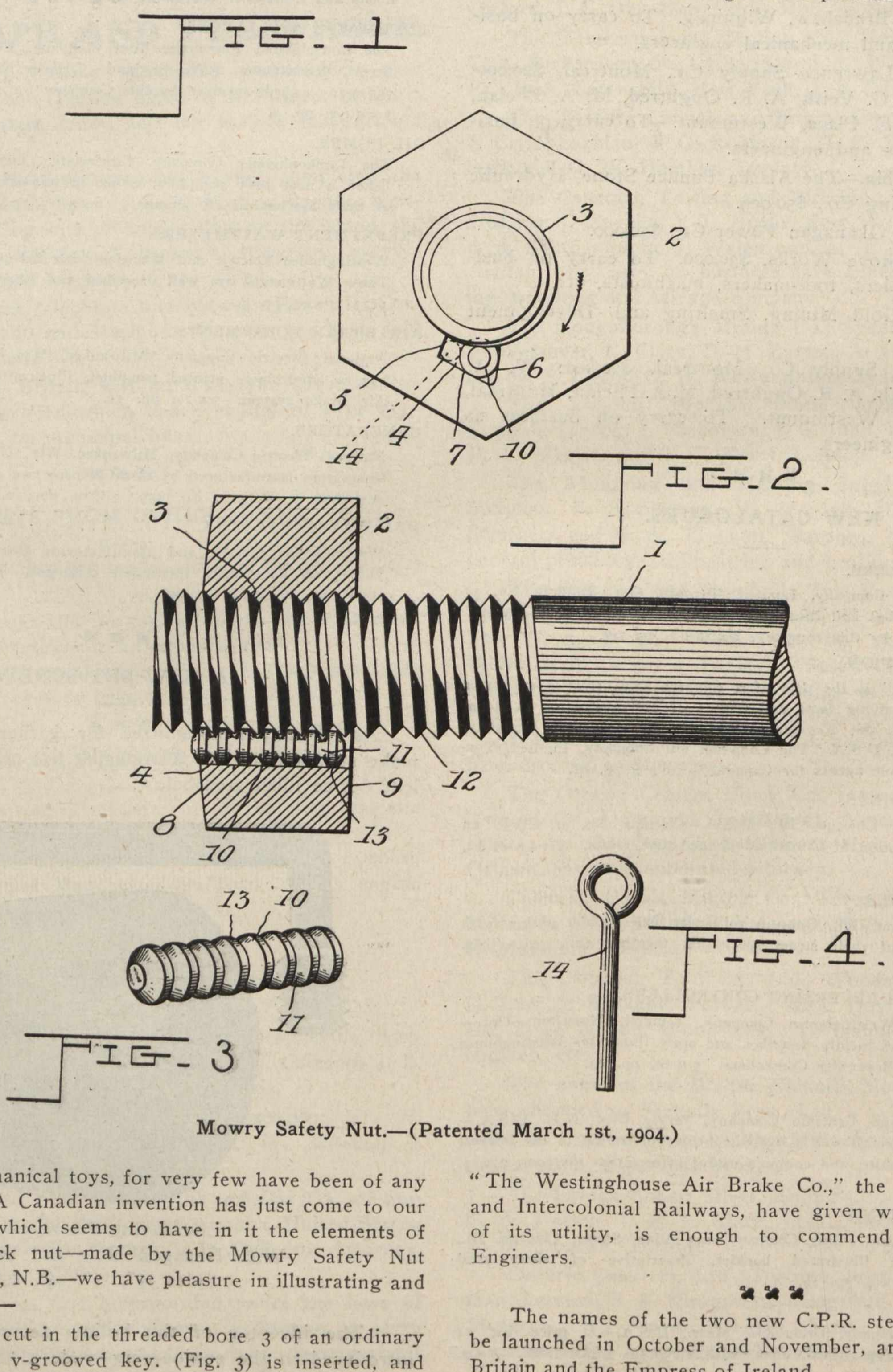
The inventor of this hollow set screw has not only introduced to the engineering trade a "perfect set screw," but is a benefactor to all mechanics who have to work around shafting. Appalling is the list of accidents caused by the old-fashioned square-headed, protruding set screws. One human arm is worth carloads of set screws. It was the humane side of this appliance that first appealed to us; but as a mechanical device it has merits not to be despised. In the first place, it is hollow—as shown by the illustration above; and the hole is hexagonal, into which a hexagonal cranked wrench bar may be inserted for either tightening or releasing. The power on the wrench is applied equally to the entire length of screw, thus avoiding torsional strain. It is self-locking; because two screws in a hole lock one another, and the stress on thread is equalized. These life-saving set screws are made of steel; are elastic: thus providing against loosening from change of temperature; and being sealed with wax, are proof against wet and rust.

A NEW LOCK NUT.

With the exception, perhaps, of rotary motors, there have been more letters patent issued for lock nuts than for any other mechanical device. Most of these inventions can be described as mechanical toys, for very few have been of any practical value. A Canadian invention has just come to our notice, however, which seems to have in it the elements of success. This lock nut—made by the Mowry Safety Nut Co., Ltd., St. John, N.B.—we have pleasure in illustrating and describing below:—

A recess 4 is cut in the threaded bore 3 of an ordinary nut into which a v-grooved key. (Fig. 3) is inserted, and engages in the threads 12 of the screwed shank of the bolt. The diameter of this locking key is such, that when it occupies the enlarged portion of the recess 4, and touches face 6, the nut is free to move upon the bolt. Consequently, if the nut is turned in the direction of the arrow (Fig. 1), the locking key would naturally recede toward the enlarged portion of the recess, hence there would be no tendency to bind or lock the nut. If, however, the direction of rotation is reversed, the key will tend to move toward the contracted end 5, of the recess. But the diameter of the key is such, that movement into the contracted portion 5 is impossible, when, therefore, the nut is turned with a view of removing same from bolt shank, the locking key which tends to roll toward the contracted area, jams itself between the face 7 and the threads 12 of the bolt, and effectually prevents any further movement of the nut in this direction. The operation of releasing the nut consists in merely inserting the extremity of the wire pin (14) into the contracted portion, so as to force the locking-key to one side.

Simple though the construction of this device is, it involves—as is evident from our description—several important mechanical movements, all of interest to the student of mechanics; whilst as regards its practicability, the fact that "The Westinghouse Air Brake Co.," the Canadian Pacific and Intercolonial Railways, have given written testimonials of its utility, is enough to commend it to Canadian Engineers.

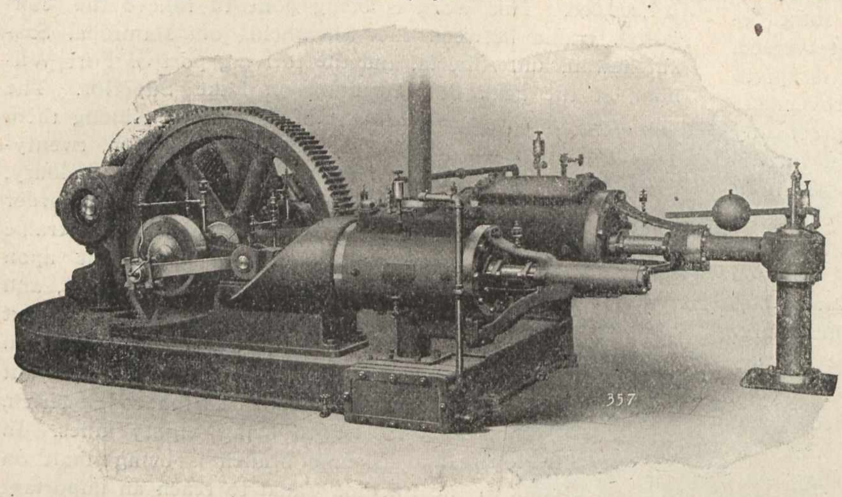


Mowry Safety Nut.—(Patented March 1st, 1904.)

The names of the two new C.P.R. steamers, which will be launched in October and November, are the Empress of Britain and the Empress of Ireland.

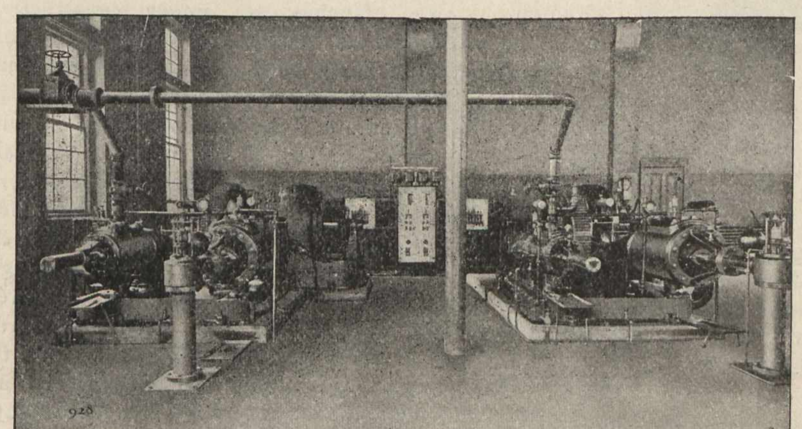
THE ELECTRICAL COMPRESSOR PLANT OF THE CHICAGO AND NORTH-WESTERN RAILWAY TERMINAL, CHICAGO, ILLINOIS.

The air-power plant at the Terminal Station of the Chicago and Northwestern Railway, in Chicago, is an excellent example of the best modern practice in the application of electric power to the compression of air, for the many purposes so characteristic of railway yard work.



The plant is installed in a small brick building, which has been very suitably located for the distribution of the air. The electric current is taken from the city mains, and is passed through transformers, which reduce it to its working voltage.

Two Ingersoll-Sergeant power-driven compressors comprise the plant.



These machines are fitted with modern devices, which contribute to their successful and economical operation. The free air capacity of each unit, running at 130 R.P.M., is 455 cubic feet per minute, and the pressure used is from 70 to 80 pounds.

The driving motors are general electric direct current type, rated at 80 h.p., running at 510 r.p.m., 220 volts. These motors are direct connected to the compressors, which are run independently, one intake duct being used for both machines.

The air is carried through discharge pipes into a primary receiver, and from thence to a system of cooling tubes, where the moisture is precipitated. From this cooler the air lines radiate throughout the yard, supplying power to the pneumatic switch and signal systems, for which the air is almost entirely used.

This plant has been in severe and continuous service for several years, and the engineers in charge report that it is doing excellent duty.

❧ ❧ ❧

—A steel containing 4.99% vanadium and 1.084% carbon failed at 140,596 lb. per sq. inch.

Galt is to have a new industry, which will be known as the Power & Gas Machine Co., and will be capitalized at $100,000. The factory, which will be 40 x 80 feet, will be erected at once, and cement blocks will be used in the building.

CANADA'S RAIL BOUNTY ENDED.

The Dominion Government has passed an Order in Council barring steel rails from the benefits of the Act of 1903 authorizing a bounty on steel structural forms. It was not by the acknowledged design of the Government that steel rails came to participate in the distributions under that Act. Apparently the extension of the bounty to rails was due solely to inadvertence, or to indistinctness of language. The statute in question provided for bounties on wire rods, on "rolled angles, tees, channels, beams, joists, girders or bridge building or structural rolled sections, and on other rolled shapes, not round, oval, square or flat, weighing not less than 35 pounds per lineal yard, and also on flat eye-bar blanks, when sold for consumption in Canada," also on rolled plates not less than 30 inches wide and ¼ inch thick, when sold for consumption in Canada. Steel rails turned out to be concealed in the passage above given in quotation marks. To the trade generally it could not appear that rails were comprehended in any of the descriptive terms there used. But when the Algoma Steel Company put its rails on the market it applied for a bounty of $3 per ton upon them, contending that they were rolled "rolled shapes, not round, oval, square or flat, weighing not less than 35 pounds per lineal yard." This claim was disputed by the Government. Instead of bringing the matter before the Court of Equity, which usually adjudicates differences of this kind, as was done in the controversy over the Dominion Iron and Steel Company's challenged bounty claim, the Government agreed to be guided by the advice of an eminent Toronto lawyer, A. B. Aylesworth, K.C. Mr. Aylesworth returned the opinion that the claim was valid. Thus the bounty on steel rails was based on a legal opinion, not on the manifest intent of the Act, and not upon a judicial decision.

That it was not the intention of Parliament thus to allow a premium for the production of steel rails, that it was not, indeed, the intention of the Minister who framed the Act, was evidently the understanding of the Government itself, otherwise the claim would not have been contested. Yet when the Government's own legal adviser submitted that the Act did thus operate, contrary to the intent of its authors, nothing was done to arrest its accidental effect. The Government could have done immediately what it has now done, nearly a year afterward—it could have passed an Order in Council restricting the operation of the law to the objects meant to be affected by it. Or better still, the Government could have introduced in the session of Parliament, closed a few weeks ago, legislation amending the Act to an exact expresssion of the meaning it was intended to convey. But neither of these courses was adopted, though it would seem that the Government must have regarded one of them as of remedial necessity. As a consequence of the delayed correction of the language of the Act the Algoma Steel Company has been so lucky as to receive $3 a ton on many thousand tons of steel rails. And a great part of these proceeds was realized upon rails bought by the Government itself. Besides paying the company the market price that it was possible to maintain by the aid of the $7 general duty, the $4.66 2-3 duty against Britain, and the $9.33 1-3 duty against Germany—to say nothing of additions to these rates for dumping—the Government contributes $3 a ton to the company. However, the $3 bounty which thus leaked out of the Act is now stopped; almost before the Dominion Iron & Steel Company had begun to share in it.—Iron Age.

C. A. C. J.

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A simple, direct, unaffected style of telling your advertising story will be most convincing. Facts briefly told are what the people need.

ADVERTISING ENGINEERS.

Products of scientific manufacture require promotion even more than do commercial articles of general consumption. The engineer or manufacturer who has spent years of work and thought upon the perfection of a new product or machine accepts as axiomatic that, because there is a need for it, there will be a demand. He forgets that before his possible customers will give up their accustomed and familiar methods to adopt the new, they must to some degree pass over the same mental course that he has traversed, and, unless educational measures are adopted, this is apt to be a matter of many years. To introduce his improvements in steam engine valve gears, Corliss was forced practically to giving his machines away. The Parsons steam turbine was an engineering success ten or twelve years before it became a commercial success in this country. On the other hand, the turbine centrifugal pump, by modern advertising methods, has been made commercially successful in a period of two years, the sales of the third year being four times those of the first, while a prominent cordage manufacturer has increased the sales of his transmission rope twenty times over within a few years by means of advertising.

Not only, however, do engineering products require an educational publicity campaign for their introduction within reasonable time, but all the methods of general advertising, suitably modified, are in some way applicable in promoting their sale. There is a science of economy of communication and apprehension, as of other things, and some ways of overcoming psychological inertia are less expensive and attended with less friction than others.

Recognizing these facts, some engineering and manufacturing concerns have established advertising departments and have placed them in charge of men of high ability. This plan, however, is more expensive than most businesses justify, and many firms attempt to handle the work through already overburdened executive officers, or else turn it over to clerks.

To meet these conditions, Mr. Halbert P. Gillette, M. Am. Soc. C.E., M. Am. Inst. M.E., formerly Associate Editor of Engineering News, and Mr. Geo. H. Gibson, A. M., Am. Inst. E.E., J. M., Am. Soc. M.E., formerly manager of Publicity for the International Steam Pump Co., Manager of the advertising department of the B. F. Sturtevant Co., and editor of the Westinghouse Companies' Publishing Department, have formed a partnership as "advertising engineers," under the name of the Geo. H. Gibson Co., with offices in the Park Row Bldg., New York City. They undertake to conduct a firm's advertising in the same manner as would a department in the firm's own offices, and are not advertising agents in the usual sense of the term, as they receive no commissions, rendering only service and leaving the actual purchasing of space and printed matter in the client's hands.

RAILWAY DEVELOPMENT IN CANADA.

There were in operation in Canada last year 19,431 miles of railways. In 1867, when the scattered Provinces of Great Britain in North America were confederated, the total railway mileage was 2,087, truly a remarkable development in thirty-eight years for a population which in the same period has increased from less than three millions to over six millions. Canada has 167 railways propelled by steam. Twenty-five of these have been amalgamated, and form the Grand Trunk Railway system. The consolidation of thirty others has produced the Canadian Pacific Railway system. The remaining 112 are more or less consolidated. The actual number of miles laid of the several companies is as follows: Canadian Pacific, 8,062; Grand Trunk, 3,159; Government railways, 1,551; other railways, 6,832; bridges and tunnels, 7; total, 19,610. The aid granted to railways by municipalities and Governments in Canada amounts to $243,926,230, or nearly £50,000,000.

The Three Transcontinental Lines.

The attention of the country is at present concentrated upon the work of the three great transcontinental lines—the Canadian Pacific, the Canadian Northern, and the Grand Trunk Pacific. The Canadian Pacific, the pioneer transcontinental road in Canada, has many important extensions and improvements under way. Chief of these is the double tracking of its present main line between Winnipeg and Fort William, a distance of 426 miles, at a cost of over £1,200,000. This work is being done to relieve the congested traffic between the wheatfields of Manitoba, Saskatchewan, and Alberta, and the thriving port of Fort William, at the head of navigation on Lake Superior. The new lines under construction total 483 miles. Among them is a branch of 227 miles, extending from Bolton, twenty-seven miles north of Toronto, to Romford, near Sudbury, on the main line. Hitherto the Canadian Pacific, in order to reach its main line at North Bay or Sudbury, with traffic from Western Ontario points, has been dependent upon the Grand Trunk, between Toronto and North Bay, and has had to share its traffic receipts with that company, but when this new branch is built the C.P.R. will have its own line from Toronto north to Romford. Another important extension in Ontario is a line from Guelph to Goderich, on Lake Huron, the total length being eighty miles. In the city of Montreal a six mile branch is being built on the south bank of the Lachine Canal to reach an important manufacturing and industrial centre.

Reduction of Grades in Manitoba.

In Manitoba facilities are to be given to settlers south of Darlingford by a seven mile extension to Kalidea. Another extension on the prairies is known as the Pheasant Hills Branch, fifty-five miles in length. Between Calgary and Edmonton two branches are under construction, known as the Lacombe and Wetaskiwin extensions. Fifty miles of construction is being done on each of these lines. The Wetaskiwin extension will eventually be carried east to connect with the Pheasant Hills branch now being built westward. The Lacombe extension will be built eastward for a distance of 150 miles or 200 miles and connected with the Wetaskiwin division. All these new lines are to meet the requirements of the rapid settlement of Western Canada, now in progress. In British Columbia an eight mile branch is being built from Yahk, on the Crow's Nest road, to connect with the railway now being built northeast from Spokane, in the State of Washington. Not the least important of the C.P.R. improvements, which are being carried out under the supervision of the company's chief engineer, Mr. W. F. Tye, is the reduction of grades on the main line, particularly on the Brandon, Broadview, and Swift Current sections. The changes on these sections will reduce the ruling grades from 1 per cent. each way to .4 per cent. each way, more than doubling the hauling capacity of the locomotives. It will thus be seen that the Canadian Pacific, by these improvements and extensions, is keeping pace with the development of the Dominion.—"Times" Engineering Supplement, August 16, 1905.

In some instances the hard-headed novice has better chances of success in advertising, for he has the advantage of being removed from the technical details that often befog the experienced advertiser, and considers methods and mediums solely upon their merits.

—William Henderson, Canadian Commissioner at the Liege Exposition, reports that great interest is taken in the Canadian mineral exhibit, which has attracted many professors of geology and mining experts. A special visit was paid to this collection by the members of the International Congress of Mining Engineers, who appreciated the practical way in which the mineral resources of Canada are presented to the public. There have been many enquiries from firms who wish to purchase Canadian ores direct, more especially with regard to zinc, chrome, nickel, cobalt, asbestos, mica, phosphate, coal and corundum. The Hadfield Steel Foundry Co., of Sheffield, England, using $2,000 worth of abrasives per month, will make a trial of Canadian corundum.