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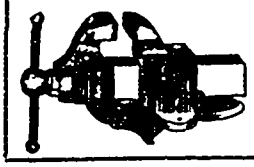

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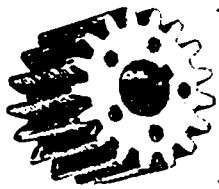

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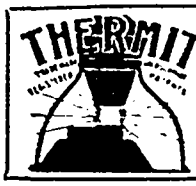

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Model Power Plants in Canadian Factories

No. 2 -DESCRIPTION OF THE STEAM POWER PLANT OF THE FROST & WOOD CO., SMITH'S FALLS, ONT.

BY FRASER S. KEITH, B.Sc.

It is safe to say that manufacturers throughout Canada are paying more attention to the cost of power than has ever before been the case in Canada.

This is partly the result of the agitation in favor of municipal ownership of electric light and power plants and the campaign carried on by advocates of producer gas. Yet, if one can judge by the plants installed during the last year or so by far sighted manufacturers, steam power is recognized as the most suitable for the average large plant.

The power plant of Frost & Wood Co., Limited, Smith's Falls, Ont., is one of the most modern in Canada. The fire which destroyed a large portion of their works in February, 1906, afforded the opportunity which a wideawake and progressive management readily recognized as the time to ensure having a new plant as complete and economical as modern engineering science could provide. In connection with their power plant they adopted the wise course (very generally ignored) of calling in specialists in power plant equipment, thus getting the advantage of the experience gained in many other plants.

The power plant is located in an isolated building over fifty feet from the nearest part of the factory. This building is constructed of stone and brick. A diagram given shows the general lay-out. In the boiler house are installed four horizontal, return, tubular boilers. Each boiler is 66 inches in diameter by 16 feet long, and is of 125 h.p. capacity, carrying steam at a working pressure of 130 pounds. The boilers are hand fired, but provision has been made for later equipping them with mechanical firing apparatus. One boiler, however, is fired with shavings which are conveyed from the wood working shops through a pipe system by means of air current. These pipes lead from the various machines in the shops, picking up the shavings and conveying them a distance of some 600 feet, and discharging directly into the fire.

It is quite interesting to observe the quick disappearance of all shavings from the wood working shops. Practically no shavings are to be seen at any point either in the shops, or in the boiler room, as immediately they are produced they begin their journey through the pipes ending directly at the fire. By this means all labor in connection with the handling of shavings is entirely dispensed with.

During the summer time two boilers only are in service; in the winter time three, so that one boiler is at all times free for cleaning. During the winter season the exhaust steam of the engines is used for heating the entire works, which is accomplished at the low pressure of one pound per square inch.

A striking illustration of the economy in heating cost to be secured by this method is the case of the office building, which until last winter, was heated by a separate system, showing a consumption of 70 tons of coal for the season. This year the office building also is heated from the engine exhaust without any appreciable increase in the fuel consumption, and the very appreciable economy of the 70 tons of coal previously required. A tunnel 5 feet by 7 feet runs from the engine room to the factory through which are laid the pipes for heating system, and the air pipes carrying compressed air to various parts of the works. It is well worth noting the distance to which the exhaust steam is carried with only about one pound of back pressure on the engines. The furthest point reached from the engines is some 600 feet.

The feed water for the boilers is drawn from the river, all the pumps and injectors for boiler feeding being in duplicate to provide for the contingency of accident, or breakdown. The feed water passes through a 500 h.p. Laurie patent feed water heater, which raises the temperature to 198 degrees Fahrenheit before it reaches the boilers.

The draft for the boilers is provided by a Custodis chimney 5 feet 6 inches diameter by 116 feet in height.

The boilers are also equipped with Foster superheaters made by the Power Specialty

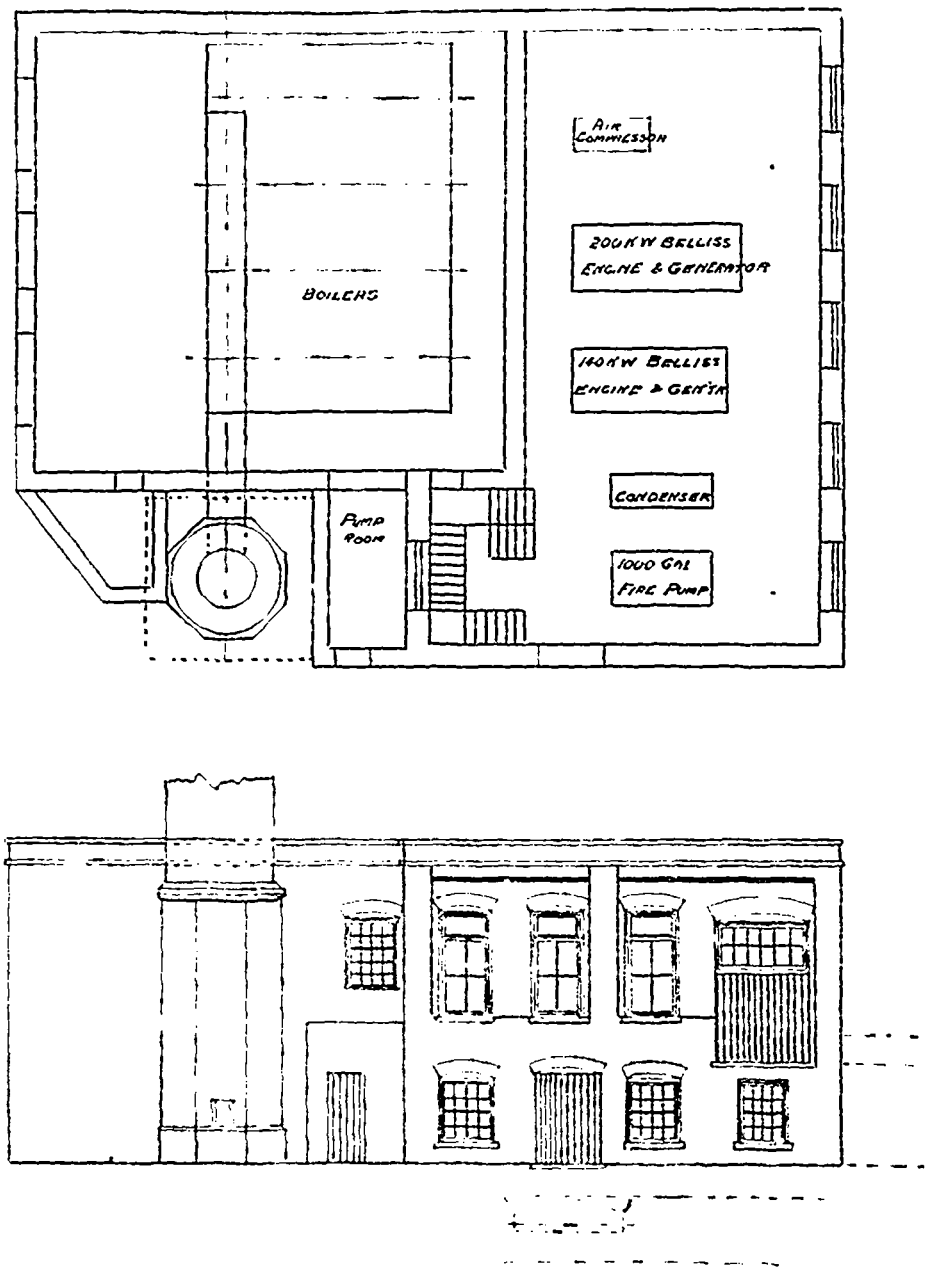


FIG. 1.—POWER PLANT, FROST & WOOD CO., SHOWING LAYOUT OF PLANT.

Co., of New York, these superheaters being guaranteed to raise the temperature of the steam to 500 degrees Fahrenheit.

The construction of these superheaters differs considerably from many others in use, as the steam is passed in a very thin layer between an inside tube made of wrought iron and an outer made of seamless cold drawn steel tubing; this steel tubing being again encased in a cast iron covering, consisting of a series of annular gills, or flanges, placed close to each other, and being so carefully fitted to and shrunk on the steel tubing as to be practically integral with it. There is thus exposed to the hot gases an external surface of cast iron, a metal best adapted to resist the action of the heated gases. This cast iron covering also acts as a reservoir for the heat and so equalizes the temperature, notwithstanding any variation in the heat of the gases. It also obviates any necessity for flooding the superheaters as is requisite in the case of bare tube superheaters, when

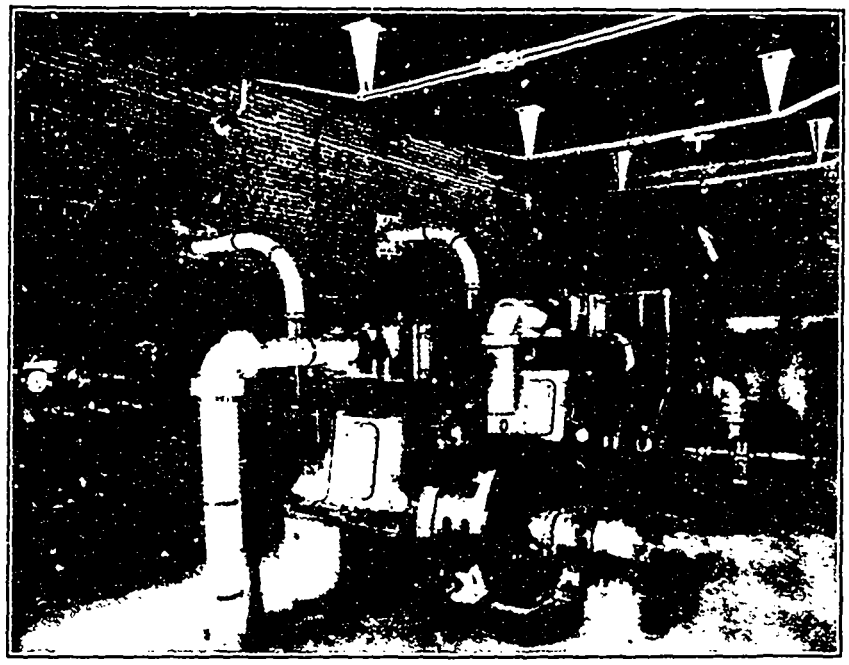


Fig. 2—Power Plant, Frost & Wood Co., Showing Belliss & Morcom Engines Direct Connected to Westinghouse Generators.

getting up steam in boilers, or whenever the load is temporarily arrested. This flooding entails risk, as many a case of water consequently getting into the cylinders has proven. In the case of Frost & Wood's plant, however, there is no necessity for flooding as the Foster superheater is amply protected by its unique construction.

Adjoining the boiler room is the engine room, which has been constructed with a basement, thus affording a ready access to the piping system; all piping, as far as possible, being placed below the engine room floor. In the engine room itself there are only two steam joints, and one exhaust joint on each engine, thus reducing the possibility of accident from leakage of joints. All the main distributing valves on the steam, exhaust, and heating systems are in the basement, but are operated from the engine room floor. All the pipes are covered with magnesia covering. There are no elbows used in the high pressure piping system, bends in all cases being installed.

In the basement are also placed the fire pump and condenser. The fire pump is an Underwriter's 1,000 gallon duplex fire pump, built by the Canada Foundry Co. The condenser is of the duplex jet type, having a capacity sufficient to condense 14,200 pounds of steam per hour, and was built by the Worthington Co

On the main floor of the engine room are placed the engines, dynamos and switchboard and air compressor.

The engines were purchased from Belliss & Morcom, of Birmingham, England, who are regarded as being quite in the front rank of engine builders, having been for thirty years builders of high class engines for the British Admiralty for torpedo boats and other service, where the requirements are most exacting. The Belliss engines are in use in the majority of the most important power plants in England.

There are two engines installed; one of 330 and the other of 200 h.p. The larger engine is direct connected to a 230 k.w. A.C. generator, built by the Canadian Westinghouse Co., and running at a speed of 360 r.p.m. The smaller engine is direct connected to an A.C. generator of 140 k.w., built by the same firm, running at 450 r.p.m. The generators are mounted on the same base plates as engines, the base plates being extended to provide for this. The speed at which these engines are operated is considerably higher than is usually adopted in Canada, and has been regarded somewhat dubiously by those whose experience has not extended beyond the slow speed engine and the ordinary high speed, which is usually unsatisfactory, and always uneconomical. A wider knowledge, however, of the experience of others, supplies a very simple answer to this criticism, in the fact that there are nearly 4,000 Belliss engines now in operation in sizes up to 2,500 h.p. each, all running at a high number of revolutions per minute. The fact of the matter is that the Belliss engine although of quick revolution is not of any higher piston speed than a standard speed Corliss engine. This is one of the secrets of its uniform success. The distinction between quick revolution and high piston speed is very clearly defined in a paper given by Mr. C. Crawford on March 7, 1904, before the "Association of Engineers in Charge," in the City of London, England. He says: "Much of the ambiguity attached to the term 'high speed' might be avoided if the terms 'high speed' and 'high revolution' in their strict sense were adopted, 'high speed' being used to denote those engines in which the actual speed of rubbing surfaces is comparatively high, and 'high revolution' to refer to rapidly rotating engines without reference to length of stroke, or diameter of bearings. Thus a high revolution engine might have short stroke and small diameter bearings but a comparatively slow speed engine."

The piston speed of Frost & Wood's 450 high speed engine is 600 feet per minute. This, as can be readily seen, is lower, if anything, that that of a modern Corliss engine of the same capacity.

The space occupied by these engines is very small in comparison with other types. Their 330 h.p. engine covers a space, 10 feet by 7 feet, and the 200 h.p., 13½ feet by 6 feet. This reduction in space has permitted a considerable saving in cost of the building. Their evenness of turning is another characteristic feature, and is accomplished with a remarkably small flywheel, the one on the larger engine being only 5 feet 3 inches diameter by 8 inches face, and the smaller 4 feet 6 inches diameter by 7 inches face. There is, therefore, no risk of a fly wheel explosion, an accident which is unfortunately all too frequent on this continent.

Oil is supplied to the bearings by means of a pump and system of piping, which conducts the oil to the moving parts. This means a great saving in labor, as there is no running around with an oil can, and drowning some parts with oil while others are forgotten entirely. This waste of oil and labor is obviated by the automatic system of force lubrication, which was originated by Belliss & Morcom in 1890, and has since been copied by several other builders. The oil supply is stored in the engine base, from which it is lifted by a simple valveless pump, and forced under a pressure of 10 to 12 pounds per square inch into the bearings. This constant and even supply of oil prevents the working parts from coming together, the film of oil taking an appreciable time to squeeze out, which is sufficient in these double acting engines, running at a high speed of revolution, to last until the strain is reversed and the shaft on the other brasses comes into operation. In single acting engines on the other hand, the stress being always in one direction there is no opportunity for the proper film of oil to form between the bearing surfaces and the wear is consequently much greater. The bearing surfaces being prevented from coming together it is claimed that there is absolutely no wear on the journals, or brasses. This statement is surprising, but in the experience of those who have used these engines for many years it is said to be repeatedly demonstrated. A concrete instance is that of an engine which after running in regular service 5½ years showed by careful measurement a wear during that period of only .0025 on the main bearings, .005 on the high pressure crank pin, and .009 on the low pressure

crank pin The oil after passing through the bearings returns again to the oil chamber in the base of the engine, so that the same oil is used repeatedly, and as all parts of the engine are enclosed, there is practically no evaporation, and no means by which dust, or dirt can get into the oil. It is not to be wondered at, therefore, that the oil bill is a very satisfactory one to the purchaser, although it may not give the same satisfaction to the oil merchant. Experience has shown that a compound engine of this type of 150 h.p. has run for twelve months making 3,188 working hours, and during this period of time used only four gallons of oil in the crank chamber, being at the rate of one hundredth of a pint for each running hour

The two engines installed by Frost & Wood, are of two crank, double acting, compound type They are exceedingly simple, in fact it is claimed for them that they are the simplest compound engines made, and have the fewest number of working parts.

Next to constant steady running, the most important point in an engine, is economy of steam The economical performance should always be stated in terms of the output or effective work done, that is in pounds of steam per b.h.p The steam consumption per indicated horse power does not show the true economy of the engine, as a certain proportion of the power developed is used up in working the engine itself. The amount of power used depends upon the size of the engine, the weight of moving parts, and the friction of its journals, piston rings and packings The ratio which the net, or brake horse power bears to the indicated horse power, in other words the mechanical efficiency expressed thus $\frac{B.H.P.}{I.H.P.}$ with the resulting percentage which varies between 80 per cent to 85 per cent for slow speed and single acting engines, rises as high in Frost & Wood's engines as 93 per cent. when running condensing, or 92.8 when running non-condensing as proved by a careful test.

Fig 3.—Power Plant of Frost & Wood Co., Showing Switchboard in Background.

A special feature of the engine, and one which contributes largely to its simplicity, is the arrangement of slide valves, requiring one eccentric and rod only. The cranks are set opposite to each other, steam being admitted simultaneously to the top of one cylinder and the bottom of the other, by which arrangement the reciprocating parts are to a great extent balanced, the strain on the bearings much reduced and a high speed of revolution made possible, without setting up undue vibration.

The engines are fitted with a centrifugal governor carried on the crank shaft and connected to an equilibrium throttle valve. The high rate of revolution permits the governor being thus applied direct to the crank shaft, thus dispensing with chain, or belt drives. The governing gear is arranged in such a way that the speed of the engine can be adjusted through a wide range of variation while running. Owing to there being two impulses per revolution the engine governing is most effective.

The efficiency of the Belliss engine generally is unprecedently high, and is accounted for by their double action and high speed with resulting small size of engine for the power developed, together with the low friction of the piston slide valves and forced lubricated bearings.

The steam consumption of the 200 h.p. engine under test at full load gave the low figure of 16.25 pounds per b.h.p condensing, and 20.1 non-condensing. Incidently this shows the superior economy which can be secured by running an engine condensing in comparison with non-condensing conditions.

The two engines are arranged with a double exhaust system so that one, or both engines can be operated condensing, or the exhaust from either engine, or both, can be used for heating purposes

As already stated the engines are direct connected to Westinghouse generators, supplying both power and lighting. Formerly the practice was to reserve one engine for lighting alone, but Frost & Wood experience no difficulty whatever in taking their lighting and power load from the same bus-bars, although the power load continually varies very considerably The advantage of this is apparent as when the load is small one engine alone can be operated The generators are of the revolving field type each generating alternating current at a pressure of 140 volts. One is 230 k.w. running at 360 r.p.m. and the other 140 k.w. at 150 r.p.m. The exciters are of 6 and 10 k.w. capacity at 125 volts. The switch board is of blue Vermont marble and contains five panels for the control of the electrical machinery installed.

In the engine room is placed a gauge tablet of black marble with nickel plated trimmings and dials 8½ inches diameter. This tablet carries water pressure gauge, high pressure steam gauge, vacuum gauge, two compound gauges, low pressure gauge for steam heating system, and air pressure gauge for the compressed air system.

A unique feature in connection with the Frost & Wood establishment is the fact that the time for the whole factory is operated from the engine room The hands on the clock dials in the various portions of the works are moved electrically, once every minute by the clock in the engine room. This clock being set and maintained at standard time by daily communication with McGill University, Montreal. The engineer also operates from the engine room the mechanism for receiving the men's checks at various points, by means of an electric current the receiver for the checks is operated simultaneously with the giving of the signal for the commencement of work, the early receiver being closed and a late receiver being opened into which the late comers have to deposit their checks By this means there is no possibility of dispute as to time, or collusion between time keepers and men, as everything in connection with the time system is automatic.

The watchman's time detector is also found in the engine room This clock has a capacity of 54 stations, but at the present time there are but 33 stations wired and in use Each station is visited every ½ of an hour by a watchman and the different stations are so located, throughout and around the plant, that every portion of it comes under a watchman's notice every ½ of an hour. It just takes a watchman one hour to visit each station that is wired.

In conclusion it might be stated that the Frost & Wood plant is well worth visiting, and for anyone contemplating the installation of an up-to-date plant, the opportunity should not be lost of inspecting this plant, as permission to do so may undoubtedly be obtained from the Company. The entire power plant was installed under the supervision of Laurie & Lamb, consulting engineers, Board of Trade Bldg., Montreal, Que.

Addison & Mamprice, printers, Toronto, have applied for a permit for the erection of a $9,000 addition to their factory on Pearl Street

John R. Ralston, of Toronto, has written the Brantford, Ont., council, asking what inducements that city can offer to an industry to be established for the manufacture of all kinds of glassware The industry in question would have a pay roll of $1,175 per week and the writer states would employ a considerable amount of hands.

Systematic Purchasing for Manufacturers.

A Method of Collating Purchase Data and Following up Promises of Shipment.

By W. R. Koller in The Iron Age.

"Buying right" is a phrase analogous to "doing well," for it is more than likely that the house which is shrewd enough to make close purchases is also watchful enough to see that the advantage thus gained is not frittered away through leaks in other directions.

To reduce purchasing to a system that will do away with all haphazard guessing and snap judgment is, however, a matter of absolute necessity in order to maintain a uniform and consistent economy. The aim of this article is to place before the reader a concise method of recording the details of purchasing in such a manner as to render the information immediately available, and also to enable the purchasing agent to judge as to the consistency of quantities requisitioned as compared with former operations.

Illustration Fig. 1 is of a card, preferably 5x8 inches arranged for collating the important details of all quotations received. There is a decided advantage in tabulating the prices and conditions of quotations in this way, saving as it does a great deal of time, which would otherwise be spent in going over the correspondence. If this tabulating is done as the quotations come in, the purchasing agent is at any time in position to order to the best advantage, should it be necessary to make a quick decision. By this method it will also be easy to note if any of those quoting have failed to comply with any of the terms of the bidding, such as the submission of samples and stating of promise of delivery, that the matter of discounts, boxing, drayage and freight are clearly understood and any other points tending to affect the net result.

These "Quotations Received" cards are arranged alphabetically, according to articles or classes of materials, by the use of guide cards, as shown in the illustration. Where the number of articles is very extensive, plain guide cards may be used, on which are written or printed the names of the principal articles or materials. The entries on the record cards may be by hand or typewriter, the latter of course being the clearer.

When the quotations are all in, and the selection is made and the order placed, the number and date of the order and the principal details are tabulated on the purchase record card shown in Fig. 2. This card, it will be noticed, has printed along the top, very near the edge, the figures 1 to 31. These are for the purpose of keeping track of and following up the promises of delivery. This is done with the aid of steel signals, which are clipped over the cards at the date of promise as shown, and may be moved along from one date to another as new promises are made.

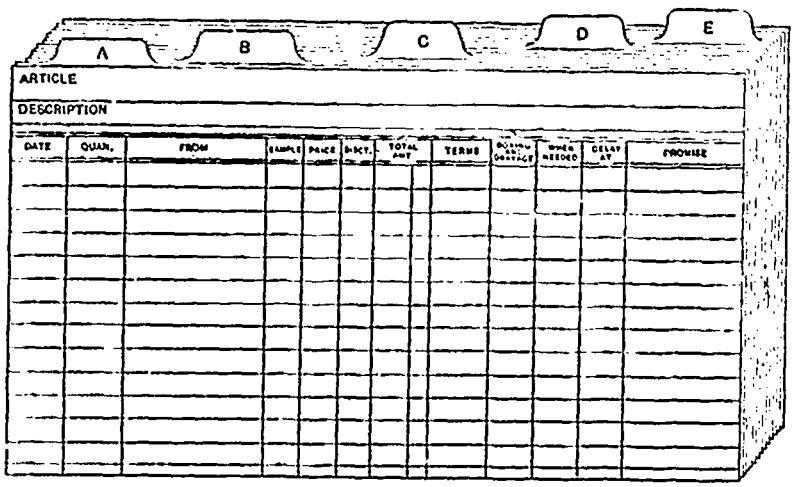


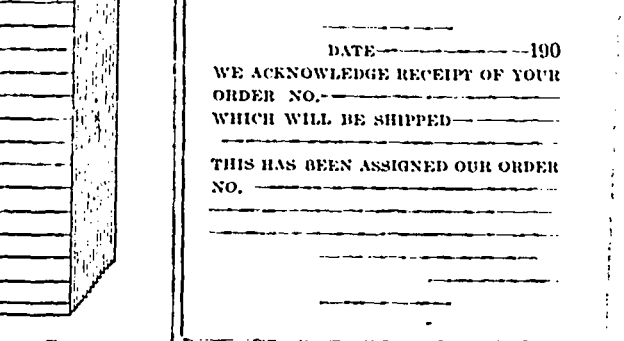
Fig. 1.—Card for Recording Quotations Received, Showing the Manner of Filing Between Alphabetic Guide Cards.

The use of these signals for following up promises will be found of infinite advantage, for as all purchasing agents know by experience, it is very undesirable to allow a supply house to become lax in its promises, with the result that sometimes a period is reached on an important job when certain materials are absolutely necessary to have at hand, and if careful following up of promises is not attended to and the order urged on, considerable losses may be the result. When orders or contracts for materials placed extend over a long period of time, with reference to their completion, signals of different colors may be used to designate the months.

The position of the signal at the top of the card indicates that action is to be taken on that order on that particular date. All orders on which promises fall due or which require attention on the same date will of course, have the signal in the same position, and all that is necessary each day is to refer to the cards on which the signal is fixed at that date. These will, of course, all be in the same relative position, one behind the other. This purchase record card is therefore of great importance in determining how various firms keep their promises and to just what extent they may be depended upon in an emergency.

When orders are sent out before obtaining a promise of delivery, as is very often necessary, it is well to send along a return postal card, Fig. 3, to be used in acknowledging the order and requiring the recipient of the order to state a definite date of delivery.

The system here described should take very little time to keep up, but it is of the greatest importance that it be followed methodically each day, for if promises are allowed to pass without attention its reliability will be at an end.


DATE——————190

WE ACKNOWLEDGE RECEIPT OF YOUR ORDER NO.——————

WHICH WILL BE SHIPPED——————

THIS HAS BEEN ASSIGNED OUR ORDER NO. ——————

Fig. 3.—Postal Card Acknowledgment of Order Form, to be Enclosed with Orders.

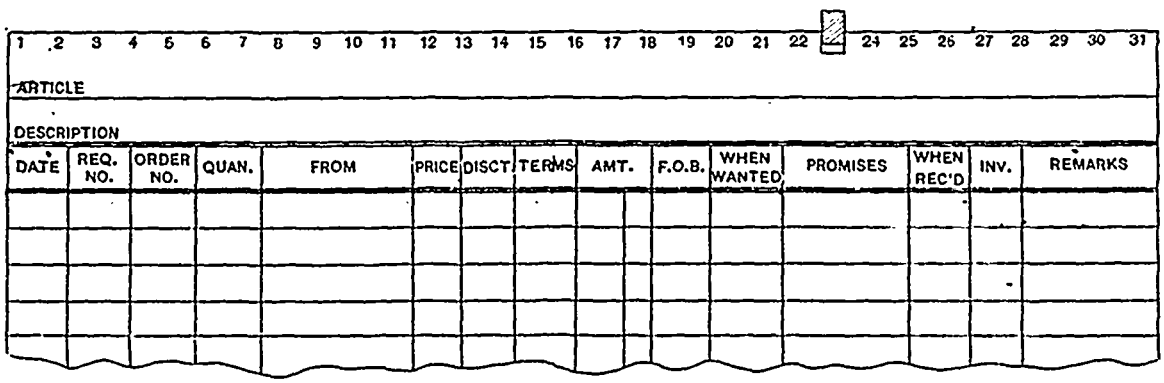
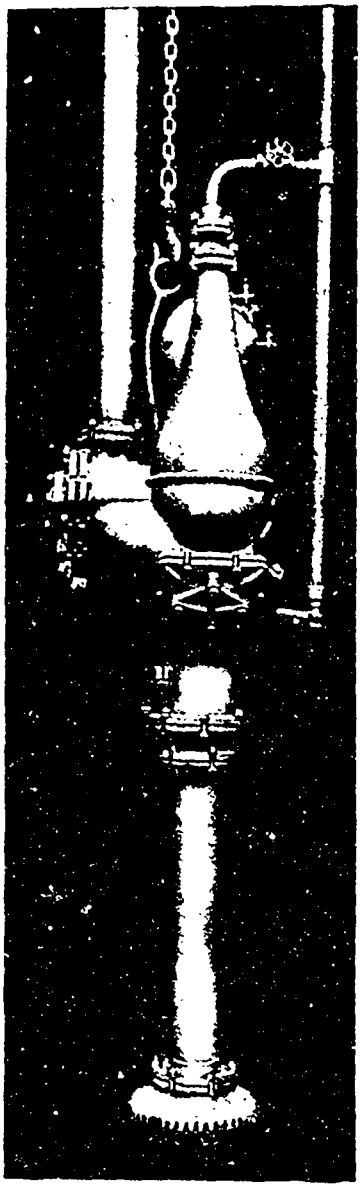


Fig. 2—Purchase Record Card, Showing the Use of an Adjustable Steel Clip or Signal, which is Moved from Date to Date to Follow Up Promises of Shipment.

The Pulsometer Steam Pump.

Almost any kind of pump can handle clean water. It is when the necessity arises of pumping semi-liquids and liquids containing gritty substances, such as mud, liquid cement, sewage, sludge, and chemical liquors that tend to crystallize, that endless trouble is met with in the use of the common piston and centrifugal pumps. It is for just such

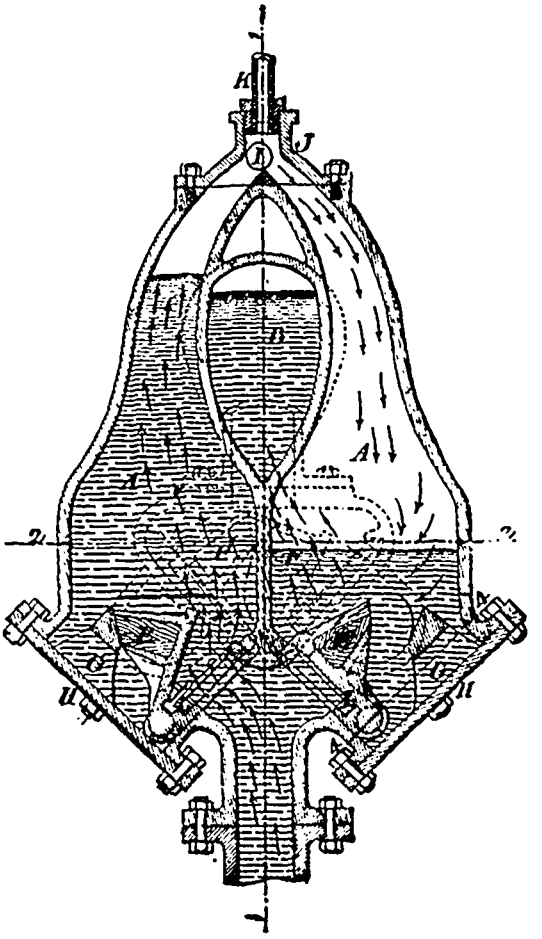


PULSOMETER PUMP AS ATTACHED.

difficult work that the Pulsometer steam pump described below has been devised. The Pulsometer steam pump consists of a single casting called the body, which is composed of two chambers (AA) joined side by side, with tapering necks bent towards each other, and surmounted by another casting called the neck (J) accurately fitted and bolted to it, in which the two passages terminate in a common steam chamber, wherein the ball-valve (I) is fitted so as to be capable of oscillation between seats formed in the junction. Downwards, the chambers (AA) are connected with the suction passage (C), wherein the inlet or suction valves (EE) are arranged. A discharge chamber, common to both chambers, and leading to the discharge pipe, is also provided, and this also contains one or two valves (FF), according to the purpose to be fulfilled by the pump The air-chamber (B) communicates with the suction The suction and discharge chambers are closed by hinged covers (HH) accurately fitted to the outlets by planed joints, and readily removed when access to the valves is required, in the larger sizes hand holes are provided in these covers. (GG) are guards which control the amount of opening of the valves (EE). Small air-cocks are screwed into the cylinders and air-chamber, for use as will be hereafter described. These are the general outlines of the construction of the apparatus, and they are sufficient for the understanding of the nature of its operations.

The pump being filled with water, either by pouring water through the plug hole in the chamber, or by drawing the charge, as can readily be done by attention to the printed directions, is ready for work. Steam being admitted through the steam-pipe (K) (by opening to a small extent the stop-valve) passes down that side of the steam neck which is left open to it by the position of the steam ball, and presses upon the small surface of water in the chamber which is exposed to it, depressing it without any agitation, and consequently, with but very slight condensation, and driving it through the discharge opening and valve into the rising main.

The moment that the level of the water is as low as the horizontal orifice which leads to the discharge, the steam blows through with a certain amount of violence, and being brought into intimate contact with the water in the pipes leading to the discharge chamber, an instantaneous condensation takes place, and a vacuum is in consequence so rapidly formed in the just emptied chamber that the steam ball is pulled over into the seat opposite to that which it had occupied during the emptying of the chamber, closing its upper orifice and preventing the further admission of steam, allowing the vacuum to be completed; water rushes in immediately through the suction pipe, lifting the inlet valve (E), and rapidly fills the chamber (A) again. Matters are now in exactly the same state in the second chamber as they were in the first chamber when our description commenced, and the same results ensue The change is so rapid that, even without an air vessel on the delivery, but little pause is visible in the flow of water, and the stream is, under favorable circumstances, very nearly continuous. The air-cocks are introduced to prevent the too rapid filling of the chambers on low lifts and for other purposes, and a very little practice will enable any unskilled workman or boy so to set them by the small nut that the best effect may be produced. The action of the



PULSOMETER PUMP—SECTION SHOWING PUMP FITTED WITH FLAP VALVE.

steam ball is certain, and no matter how long the pump may have been standing, it will start as soon as dry steam is admitted.

The steam ball, if once made true, wears itself and its seats true, as it turns in its bed at every stroke, so that no part of its surface falls twice in succession upon the seat. If properly constructed, a spherical steam valve working in a true seat has proved itself the best of all forms of distributing valve which have been invented, but unless judiciously made by special machinery and appliances, disappointment and waste of steam may ensue; the long experience in this respect of the Pulsometer Engineering Co. is a guarantee that every precaution has been taken to ensure the best result in the construction of this most critical part of the apparatus.

Various types of valves have been found necessary to meet different conditions Flap valves, as shown in the accompanying illustration, consisting of an iron flap with wood seats (hickory endways of the grain) are used where the action of the liquid pumped is detrimental to rubber. Ball valves are convenient for various requirements A special metallic valve is sometimes used where high temperature or other circumstances render rubber unsuitable. All these valves are so designed as to be readily replaceable in case of wear. For general work grid valves, consisting of a grid of brass and a rubber disk are favored because of their ease and cheapness of renewal.

A unique feature of the Pulsometer pump is that it will work just as well suspended from a chain or rope, as shown in the second illustration, as if it were permanently fixed and this feature, together with its very small size in proportion to the quantity of water thrown, makes it available in a great variety of awkward situations.

The fact that it absorbs its own exhaust steam is of great importance where it must be used in confined space.

The Pulsometer steam pump, it will be seen, is remarkably simple in construction, requires no lubrication, has very few moving parts, and wearing parts can be very readily and cheaply renewed.

The various uses of this pump are described in an attractive catalogue recently issued by Mussens, Limited, Montreal.

Safety and Comfort in the Shop.

From the Open Shop.

Contributing, probably as much as anything else, to a general high shop standard and satisfaction of those employed, is the carrying out of certain details, many small in themselves, but in the whole, creating a shop in which the conditions of work are felt to be favorable.

Naturally the class of work carried on limits what can be practically done in these matters;—just as, for instance, a drop—or heavy-forging shop, from the very nature of the machinery, heating appliances, etc., and the smoke, cinders and dirt resulting from their use, can not offer the same possibilities for cleanliness or good flooring as a toolroom, or a department of moderate-sized machines; but this much is certain, any shop in which close attention is given to details of comfort and safety, gets for itself a wide reputation as a good place to work, no matter what may be its nature; unless, as is rare in connection with the rest, some certain shop feature is particularly objectionable

From this there naturally follows many things mutually helpful to everyone connected with the shop. The increased number of applications for work by all classes of men enables the selection of a high grade of shop employes, and greatly facilitates their regular retention in employment, a condition whose value is acknowledged. Besides it brings about better work, faster production, and, not least of all, the acquired familiarity with what is regularly done brings almost without exception, as it should, higher total wages.

These conditions of safety and comfort, to which reference will be made, should not be confused, as is too generally done, with the so-called welfare or betterment work, as they almost altogether concern conditions strictly in the shop itself.

It is hardly necessary to do more than refer to the benefits derived from a building design insuring ample window light throughout the shop during the day; and as well from the installation of a thoroughly adequate lighting system, so located in detail as will best furnish illumination at the working machines during the hours when some artificial light is needed. And it is not out of place to recall just here that attention to this will not only very materially aid in the production of good work, but will also, to a noticeable extent, reduce the element of personal injury to employes, especially in the use of certain machinery, such as punch-presses and those having exposed gears or irregularly moving parts.

Curiously enough this matter of exposure to personal injury is one which seems, from the records, and the attitude of many shop workmen, to be less considered by themselves than is often a simple matter of convenience. All shopmen frequently, probably mainly through the disregard which familiarity brings, take extraordinary risks for no reason at all. There is no question but that employers are blameable in many cases of injury, but it is just as certain that the working shopman is himself frequently the responsible one. For a little convenience, or to save a small exertion, risks are taken regularly which an unaccustomed person would be at much pains to avoid.

In the very case of punch-presses, when the character of the work necessitates the feeding of material by hands in immediate closeness to the punch-tools, objection is often made by punch-press operators to a removal of the foot treadle, and the substitution of a handworked lever which, for operation of the press, requires the removal of the hand from a dangerous position. It is safe to say that a majority of the accidents occurring in punch-press operation happen through an involuntary moving of the foot-operating treadle; frequently in connection with a quick effort to withdraw the hand from what is suddenly recognized as a dangerous position. The substitution of a hand for a foot operated throw-in mechanism would greatly lessen this danger where it exists, yet, as said, the change is frequently opposed by workmen on the sole ground of less convenience. Under such circumstances it is plainly a matter for the superintendent to come to a decision as to what is best after careful consideration, so as to avoid both risk to the employe and possible financial liability to the employer.

The proper encasing of exposed gears is not a difficult matter to carry out as a rule and its advisability is generally accepted the more so that it rarely involves any change in the working method of machine operation moreover, it very greatly prevents any access to the gears of material capable of producing breakage or excessive tooth-wear Encasing removes a considerable element of danger indeed, even a simple metal-guard shield greatly aids in avoiding possible injury to men in the shop from the effects of carelessness or inadvertence on their part; and may well be installed where a complete casing would be impracticable, or of excessive expense.

Railings for flywheels are in a similar class of shop-accident preventives, but with careful location in order that there may not be a source of danger introduced through a possibility of being caught between the guard-rail and the wheel itself. Heavy netting, properly shaped and secured so as to cover the flywheel, is particularly adapted for this purpose, as it permits very easy inspection, and access to the bearings, etc. while still preventing any other than deliberate contact with the wheel. In some cases similar cages for belts and pulleys are greatly needed generally where their location is such that much passing-by goes on

Automatically closing elevator doors or gates are now a device so widely adopted that it is familiar, nevertheless these are often insufficiently inspected and cared for so that in these cases may readily become an actual source of danger through the dependence placed upon them in the absence of a lack knowledge, by every employe, of the actual faulty condition. The inspection of the condition of this sort of safeguard, made of every one, is constant in many shops and notices of warning are often held ready for posting whenever any safeguard appears out of order. Only in this way can negligence on the part of the inspecting force be prevented and notification of the existing danger generally given.

Of a somewhat similar preventive nature but really combining the two elements of safety and comfort are exhaust devices for removing the dust produced in certain shop operations, notably those of buffing, grinding and polishing, and to somewhat lesser degree the wood dust in some woodworking departments. The fumes inevitably occurring in some lines of work also suggest need for thorough ventilation, even, though the reason of being accustomed to the fumes no objection is made to their presence by the shop employes

Of course, every avenue leading to accidents to employes or interruption of the work by illness, can not be foreseen and closed; many accidents are indeed unavoidably incidental from the very nature of the machinery and the use of power, but that all possible precautions are due to employes is a growing conviction among employers who do not wish to be exposed to even the temporary loss of a good man, or to the unexpected costs which have their origin in a doubtful idea of economy.

The Dominion District Steam Heating Co. have issued writ against the Berlin District Steam Heating Co. for $50,000

Power Losses in Transmission.

By T. E. Ryder, Manager Power Transmission Department, The Canadian Fairbanks Co., Limited, Montreal.

Power transmission is given but little thought by the average power user The subject, however, should be a matter for serious consideration. Investigation along this line has shown that the loss of power by transmission devices varies from 5 to 80 per cent. of the total power consumed, the average loss being from 30 to 35 per cent or, in other words, one-third of the power generated is being used to turn non-productive machinery.

I would like to have you verify this statement some noon hour by putting all belts to machines on loose pulleys, and see what your idle load amounts to. This can be done by furnishing your engineer with an indicator.

A common error is to have the belts too tight. This causes the shafting to bend, and the increased pressure adds considerably to the journal friction. If it is possible, put on larger pulleys, or use a wider belt to decrease the working load.

Pressed steel pulleys are preferred to iron pulleys, because they only weigh about one-third as much.

It is estimated that every ton pressure on the bearing, whether by weight or by tension on belt, takes one horse power to turn it 250 revolutions per minute

Shafting out of alignment is the cause of the loss of an immense amount of power In a new building shafting should be realigned every three months, and great care should be taken that where wood stringers are used to see that the lumber is thoroughly seasoned I find it necessary to line up the shafting in most buildings two or three weeks after the shafting is erected This is caused by the building settling and the wood shrinking after the heat is turned on in the building

All modern shaft hangers have both horizontal and vertical adjustment for the bearings This makes it much easier to accurately align the shafting and to do it in about one-quarter of the time it takes with a hanger having but vertical adjustment. The vertical adjusting screws should be large enough to furnish a rigid support for the bearings Hanger frames made of cast iron are preferred to steel frames, because there is no spring to them, and are consequently much more rigid.

We now come to the most important point of all the subject of bearings—as this is where the friction load comes The ring oiling babbitted bearing is the most popular of the self-oiling sliding friction type, because this means of lubrication is the most positive and more nearly approaches a thorough oil bath It is, however, a question of lubrication entirely, and while it is the best of this type it should be carefully watched and the reservoir cleaned at least once a year and refilled with good mineral oil about 250 viscosity The ordinary standard bearing that requires to be oiled twice a day is used but very little at the present time, the item of time spent in oiling amounting to much more than the increased cost of the ring oiling bearing.

J. F Springer, in an article on ball bearings which appeared in the July numbers of the "American Machinist and Power," says:

"Probably the great bulk of ball bearings, if we except a few styles made in the last few years, have been constructed on more or less erroneous fundamental principles"

He also says in reference to friction in ball bearings:

"That which arises from the sliding contact of balls, with balls, is attracting the attention of many inventors The point should be emphasized that this friction is a sliding, and not a rolling one. A little attention to the subject will convince one that the balls are rotating in opposite directions at the point of their mutual contact. It would seem that the only effective means of eliminating this source of sliding friction is the introduction of a ball or roller, or the equivalent, between consecutive bearing balls, in such a manner that the separating means is

Mr T E. Ryder.

Mr Ryder has charge of the Transmission Department of the Canadian Fairbanks Co., with headquarters in Montreal.

not in pressure contact with either raceways. A separating device which does not roll would have but little effect apparently, as the slide would still remain."

This feature, and because manufacturers have come to realize the necessity of using larger balls, on account of their load carrying capacity, also that it is possible to-day to get steel, the hardness and toughness of which has never before been equalled, makes it possible to furnish a bearing giving almost universal satisfaction This intermediate ball between the load carrying balls is commonly called a double ball bearing, patents having been secured on same by Mr Chapman, of Boston, Mass.

My practical experience, and the experience of others I know who have used double ball bearings, is such that I do not hesitate to state that the defects found in other rolling friction bearings, are practically overcome by the double ball bearing. That a tremendous saving of power can be effected by using double ball bearings is generally acknowledged. Various tests made with this type of rolling friction over the sliding friction bearing have shown a saving of over 75 per cent. of the entire shaft friction. These bearings have been in continuous service for seven years, and last fall I examined the bearings in the first mill equipped with them in the New England States, and all of them appeared in perfect condition I might state that in this mill they are running 24 hours a day, this service being equal to more than 14 years in a plant that runs but 10 hours a day I also recently examined a bearing that had been running about 350 revolutions per minute for over three years, and there is absolutely no sign of wear.

The first cost of equipping a plant, with modern transmission material, is heavy, yet in most cases the cost of such equipment will be wiped out within a year on account of increased savings.

In these days of keen competition it is necessary to take advantage of every means to reduce the cost of manufacture. The saving in power that can be effected in the average plant will reduce the cost of the manufactured article from 1 to 2 per cent.

AN IMPROVED WATER LEVEL GAUGE.

It is often advantageous in hydraulic engineering to automatically register the fluctuations in height of water, in head and tail races, rivers, reservoirs canals, sewers, forebays, etc Many devices have been used for this purpose but in practice troubles have resulted from mechanical complexity, difficulty of installation and the effect of cold weather on this apparatus.

These objections have been overcome in the Bristol water level gauge by using air pressure for transmitting the motion.

A double bell casting is located permanently at the lowest point to which the water will fall. Between the halves of the bell a diaphragm of thin sheet rubber is placed so that the water pressure below compresses the air above; this pressure being transmitted through a flexible copper tube to the recording portion

It is seen, therefore, that all moving parts have been eliminated except the rubber diaphragm which is permanently located below the freezing point in the water. The recording portion may be located at any convenient distance from the water and can be equipped with either daily or weekly charts of almost any capacity.

These recorders have also been developed for registering the depth or volume of oil, in fuel-oil or storage tanks.

They are made by the Bristol Co. and described in their new bulletin, No. 69, which will be sent upon request from the nearest office, New York, Chicago, or Waterbury, Conn.

The Brantford Bedding Co., Brantford, Ont., have assigned.

H H. Vivian & Co have secured judgment against F. H Clergue for $33,556.

Louis Englehorn, John Vanderslice and J. Raymond Beaudry have registered under the style of Special Machinery Mfg. Co., Montreal.

The Requirements of Good Fire Brick.

THE ARTICLE BELOW BY A. S. ATKINSON IN THE CLAY WORKER WILL BE OF VALUE TO MANY USERS OF BOILERS AND REFRACTORY FURNACES OF ALL KINDS.

In engineering practice for boiler setting and construction of refractory furnaces of all kinds, the fire brick work depends to a large extent upon the nature of the bricks used. In the past too little attention was paid to the relative value of fire bricks, and engineers accepted whatever materials were furnished them. As a result, fire-resisting structures were often short-lived and inefficient. Ordinary bricklayers not accustomed to using fire bricks were also partly responsible for the failure of many structures to answer the purposes for which they were designed. More exact engineering practice to-day demands grades of fire clay brick which will yield certain definite results. This is particularly true of engineers engaged in the erection of high class water tube boilers and stoker furnaces where the very best fire brick and masonry work is essential.

There are several grades of fire brick in use and most manufacturers supply at least two, if not three, of these grades. Engineers in the construction of boiler and furnace settings recognize the fact that the second and third grades of fire bricks have their proper use, but the confusion of one with the other is fatal to success. In the effort to secure the very best grade of fire brick, many kinds of clay deposits have been tried, and the finest form of fire clay called kaolin is composed entirely of silica, alumina and water.

Most of the brick used for boiler construction contains from 60 to 80 per cent of silicia and from 20 to 30 per cent. of alumina. The question of the relative amount of these two materials found in the bricks and the absence of impurities, determines to a large extent the fire-resisting capacity of the bricks. Manufacturers of the higher grades of fire bricks, instead of trying to conceal the composition of their products from engineers, furnish to-day an analysis upon application. The leading engineers demand this before they recommend fire bricks for the highest work.

One of the best known fire brick on the market is guaranteed by the manufacturers to be composed of 33 per cent. of calcined flint, 57 per cent. of raw flint and 10 per cent. of plastic clay. Recent analysis of the bricks made by a prominent firm of constructing engineers showed that the bricks were composed of 68.50 parts of silicia, 29 of alumina, 1 of ferric oxide, 0.80 of lime, 0.25 of magnesia, and 0.70 of alkalies When tested by heat the bricks glazed at 3150 degrees Fahrenheit and fused at 3300 degrees F. This high fire-resisting quality indicated the value of the bricks for furnace and boiler work. In boiler setting work the fire-resisting qualities of the bricks are the most important factor and must always be first considered.

A DISTINCTION MUST BE MADE.

In bricks used in glass and steel furnaces and fire bricks for boiler settings. The former are silicia bricks which will resist a very high temperature, but owing to their very brittle nature they are not suited for boiler work. Thus a sudden strong draft of cold air will cause them to splinter at the ends and corners. Where silicia bricks have been used for designing arches and furnace walls, they have given poor satisfaction for this reason In furnace work of this kind the expansion of the bricks must be considered. The iron and steel parts of the boiler expand and contract under variations in temperature, and if the bricks do not show a certain amount of elasticity they cause cracking in the structure. Nothing is so fatal to boiler work as the chipping and breaking of the ends of the bricks and fire bricks differ from silicia bricks in that they contract when heated

The presence of certain impurities in fire bricks up to a certain percentage does not injure their value, but on the contrary improves their usefulness. Most of these impurities act as a flux when the bricks are heated. If the presence of the impurities is increased beyond a given point the bricks soften and even melt under high temperatures

FIRE BRICK TESTS.

Engineers in using fire bricks detect the presence of carbonates of lime and magnesia by testing them with muriatic acid. A large percentage of either lime or magnesia reduces the fire-resisting qualities a good deal. Oxide of iron and salts of potash and soda may also be present in small quantities without causing trouble. The oxide of iron should not be in greater quantity than 2 per cent. and less than this is more satisfactory. In the best grades of fire bricks the impurities should not be greater than 2.5 per cent. Up to this point no great harm is done, but if these should be increased to 5 per cent. the fusing point of the bricks is reduced by 300 degrees F.

Some fire bricks become soft long before the fusing point is reached and naturally they prove inferior for boiler setting and furnace work. The reason for this is that flat arches made of such bricks would tend to settle and under high temperature a general collapse might follow. In addition to this there is the danger of pulling out the arches when soft in removing the clinkers and cleaning the fires.

INITIAL COST A SMALL ITEM.

The cost of high grade fire bricks is not taken into consideration by engineers to-day in specifying for work in boiler setting. The initial cost of the bricks is a small item compared with their lasting and durable qualities The first-grade bricks, costing $35 per thousand, are cheap in the end if they develop all the refractory powers demanded of them. Second grade bricks, at $30 per thousand, are sometimes suitable for constructing the combustion chambers, although the arches and skew-backs for stoker and smokeless furnaces should be built entirely of the first grade fire bricks. The lining of the fire box should also be composed of first grade bricks as far back as the bridge wall. The hardness of the bricks should also be considered for this work, although fire-resisting powers must command first attention. Fire bricks for the arches and skew-backs should not soften under 3,000 degrees Fahrenheit.

BOILER AND FURNACE SETTINGS.

In building boiler settings and furnace backs, the mason frequently makes errors which are sometimes attributed to the failure of the fire bricks. The most common mistake is to use fire bricks which have been broken or chipped at the corners in transportation In ordinary brick work a mason will cut and break his bricks to fit spaces and at the same time utilize half bricks and chipped bricks. In furnace and boiler work nothing is more fatal to success. No mason can break or chip off his bricks as accurately as the manufacturers can press them with machines When the mason attempts to use all of the bricks purchased, he will make a poor job Many rounded and broken corners will have to be filled in with fire clay, and as a result this part of the wall will disintegrate first Sometimes after the first intense heat the brick work shows signs of weakness, and the fire clay filling will quickly crumble.

Most manufacturers of fire bricks carry standard sizes suitable for almost any needs and many engineers design their construction to suit the stock bricks. The shapes and sizes are approximately correct, but where special work is to be performed no stock bricks may answer the purpose. This is particularly true of the skew-backs, and it is not uncommon now for engineers to draw special sizes of skew-backs and have them made to order. This entails extra expense but in a large, important boiler plant it proves the cheapest method in the end.

FOR REAR OF BOILERS.

The second-grade fire bricks used in the rear of the boiler do not have to be set up with such great care, and the uniformity of the bricks may not be so exact In nearly all furnaces, this rear work of second-class bricks outlasts the best work of the arches and skew-backs. The lining of the fire box usually gives out first, and replacing this with new bricks frequently imposes a cost upon the upkeep of the plant that is an important factor. The effort of engineers to-day is to secure a higher grade of material and work for the front of the furnace so that the brick lining will last as long as that in the rear. Then the repair of the whole furnace can be carried on at once, and the life of each fire brick masonry can be calculated upon in advance. With the cooperation of the designing engineer, bricklayer and manufacturer of fire bricks, this achievement has been well nigh attained in some of the larger plants.

With uniformity of fire brick in size, contraction and fusing obtained, the question of the size of the red bricks for the backs should be carefully considered They should be selected with as much care as the first grade fire brick, for otherwise the welfare of the two in the whole structure cannot be made exact and satisfactory. The appearance of these bricks is of less importance than their uniformity of size. Header courses must be put in about every fourth course

which gives close finished work. Unless the red bricks are of uniform size with the fire bricks it will be impossible to make the header courses perfect, and extra wide joints will have to be filled in. It is essential that all header courses should be laid up absolutely on a level.

In flat arch work with fire bricks for boiler settings, the skew-backs are the vital key to the whole situation. Upon their shape, size and durabi ity, depend to a large extent the whole work. Usually, engineers select their skew-backs from the standard sizes carried by brickmakers, but in first class work, specially moulded skew-backs to conform to the needs of the situation will give better results The structural steel back of the skew-backs to carry the thrust of the arch, cannot support the load unless the skew-backs are designed to fit snugly in position and perform their work satisfactorily.

In building an arch of almost any degree, it is possible to perform the work well with stock or standard size fire bricks. In an arch of 60 degrees wedge bricks, tapering from two and a half to two inches, flat bricks can be used at about every fourth course. In fact almost any circular work can be designed with the wedge bricks of standard size, and the joints between made very narrow. On the design of the skew-back, however, must the work depend chiefly for its final results.

Engineers no longer accept the old idea that a fire brick is merely a fire brick, and all are about the same. The difference in hardness, durability, uniformity of size, and composition is well recognized to-day in the best engineering practice, and the manufacturers who cater to the best trade must conform their ideas to the needs of the engineering profession That many do this, is apparent in the grades of bricks which are coming from the best brick yards Some of these fire bricks show as much improvement over those made a dozen years ago as the modern steam engine is superior to its prototype of half a century ago. In other words, the manufacture of high grade fire bricks has developed rapidly and attained a high degree of efficiency. As a result of this improvement the boiler and furnace settings of our large steam plants last nearly twice as long as they could under the old practice Better materials and superior methods of manufacture are the key note of the improvement.

Best Method of Wood Firing.

AN ANSWER TO AN ENQUIRER.

I should be glad to learn from men having experience in firing return-tubular boilers with wood the best method of setting such boilers for this fuel, and the best way of firing them The wood to be used is at times good straight pine, 3 to 4 feet, and at times a crooked scrub oak, which seems to give very poor results, especially if wet. Sometimes a mixture of pine and oak is used, which seems to do better than either. How about the grate area—does not wood require less than coal? Is there any advantage in tapering the sides of the fire-box, making it wider at the top so that crooked wood will tend to press together as it falls, and leave fewer holes in the fire?

How about regulating the quantity of air taken through ash-pit doors—is it advisable for best results, to shut these doors partially after the wood has caught, as some maintain? In fact, I should be glad to learn everything possible about the best way of handling such fuel under boilers, in order to get good results and keep the wood bill down. The native (Mexican) firemen are very hard to teach, and when wood is poor or a little wet, keeping up steam in the mountains is sometimes a serious matter.

W. H. V.

THE ANSWER

Cordwood can be burned on an ordinary coal grate, but it is better to lower the grate bars a few inches in order to get room for the wood. Wood firing is very hard work, and the wood cannot be supplied to the furnace continuously. This necessitates providing what might be considered storage space for the fuel. With the exception of lowering the grates, it is not necessary to make any change in the boiler setting The decreased height of the ash-pit has no bad effect, since clean wood contains only about ½ of 1 per cent of ash. Furnaces can be run for a week at a time without cleaning out the pits. Wet wood always gives poorer results The crooked scrub oak referred to we judge to be smaller in diameter and composed of whole sections of trees or limbs of trees If this is the case, then the percentage of bark is high. Bark is low in heating value and high in ash. The crookedness of the sticks would prevent close piling and would make a strong steady fire impossible with any reasonable amount of exertion from the fireman. Oak makes a hot lasting fire and should give good results when used together with ordinary good fuel wood, especially if the fire is kept well poked down and compact.

Wood requires less draft than coal, and more wood may be burned per square foot of grate surface than the equivalent in coal. This is true whether we consider an equivalent weight of coal or an equivalent heating value in coal. Commonly, however, the grate area is not reduced, since it is desired, from an operating standpoint to get all the room possible for the fuel in order to avoid the necessity of firing almost continuously.

If the fire-box were made specially wide at the level of the fire doors, so as to get a maximum space for fuel while contracting the grate area, there would be some advantage with a smaller grate area, for burning a stated amount of fuel, since the excess air supply could be more easily kept down. This would involve a special boiler setting The tapered sides of the fire-box could not be depended upon to compact the fuel to any great extent. A reduction in grate area from the standard ordinary width of fire-box at the fire-door level would be bad, as it would decrease the fuel space. Wood requires much less air for combustion than coal.

Chemically, wood is a fuel rich in oxygen, so rich that the hydrogen present is often entirely in combination with oxygen as water. Even when this is not the case, the available hydrogen is very small in amount. When the oxygen is in excess of the amount necessary for combination with hydrogen, it serves itself as a supporter of combustion, thus decreasing the amount of air to be supplied. The heating value of the wood is therefore practically that of the carbon alone, and the necessary air is sometimes only half of that necessary to be supplied for an equivalent weight of coal. Since the heating value of the wood is itself about half that of coal, the temperature of the furnace with wood and a properly controlled air supply is about the same as with coal. Of the heat generated by the wood, a portion is transmitted into steam in the boiler, and another portion escapes at the stack. The amount of loss to the stack depends upon the temperature of the gases as they leave the boiler and the amount of these gases. The greater the amount of gas the greater the loss to the stack, and since the gas is made up of the fuel itself, plus the air supplied, any excess of air supplied over that which is just necessary for combustion, results in a serious loss.

The ash-pit door should be kept nearly closed at all times, and the air supply should be especially decreased just before firing when the wood on the grate has been pretty well burned down The best results are obtained by carrying a very light draft and closing the ash-pit doors as closely as the quality of the wood may permit. With very poor fuel it is sometimes difficult to get combustion with as low a draft as is desirable. The best way to burn low-grade fuel is to put it through a "hog" and use a mechanical system for firing the chips in a separate combustion chamber —Power.

Efficient Foremanship.

A short time ago, while walking through a machine shop of a large machine-tool building firm, the superintendent called our attention to a middle-aged man standing in front of a bench near a group of automatic gear cutters and engaged in testing a gear which had apparently just been cut Six years ago that man was a common laborer and was at work cleaning old bricks just before entering his present employer's service, says a writer in American Machinist. The superintendent with whom we were talking needed help, noticed this man at his laboring work, hired him, found him capable, took an interest in showing and teaching him, and to-day he has charge of all the automatic gear cutters, cutting thousands of gears each year, in the shop which he entered as a common laborer.

On the following day we visited another machine shop and the owner pointed out an active man at work on a group of milling machines. Four years ago that man was carrying castings around the shop, snagging, sweeping the floor and doing all kinds of laboring work A milling machine hand was needed and decided to give him a trial, at the same time interesting himself in the man's progress and instructing him thoroughly in the details of the use of the machines To-day that man is a working second hand on a milling machine job having a large variety of machines.

The advancement of these two men from the rank of a common laborer to that of a skilled mechanic doing executive work shows plainly the efficient foremanship under which they have worked. Such foremanship is to be commended, and presents a striking comparison with the attitude of the foreman who requires the most skillful workmen throughout his department in order,

if possible, to cover up his own deficiencies A manufacturing machine shop department filled with high-priced help is apt to run itself, rather than to be run by the foreman in charge; but the man who can produce the quantity of work required at a reasonable cost and with efficient labor, though not necessarily highly paid, is the one who is getting real results. The unskilled man works for low wages for two reasons: one because of his inability to produce through lack of knowledge and training; the other because he must pay, indirectly of course, for the necessary expert supervision in order that he may produce to the advantage of his employer This expert supervision comes through the medium of his foreman, and it is his right that he should be properly instructed in order that he may gain efficiency.

Men who are lifted from the position of the common laborer to that of the skilled operator often become the best men in manufacturing departments and add an element of strength to the factory's organization because of the relationship which exists between them, as efficient workmen, and the foreman who has been instrumental in increasing their efficiency A successful foreman should produce the work from his department in a large quantity, for a low price, with all the necessary elements of accuracy and with efficient labor. Successful foremanship, in the future still more than in the past, will train and develop unskilled laborers into efficient producers However, such development is of necessity special and cannot take the place of a broad training in general machine shop lines

Moving a Shop.

B. Hander in Machinery

It is sometimes necessary to move a manufacturing plant, particularly one renting quarters, from one place to another, either because the present place has to be vacated to give room for somebody who is willing to pay higher for the lease, or because cheaper and better quarters can be obtained elsewhere. This moving time is one of uncertainty of hours for all employed, and it makes the young apprentice swell with pride to have the superintendent approach him and ask him to work to-night, and he feels under moral obligation to tell every one he meets that "we are moving now, and I will have to work to-night."

At a time of such a shop moving, the most important thing is to have everything about the moving settled beforehand The men in charge must determine upon exactly where every bench and machine should be placed in the new building in order to provide for the greatest convenience. The first thing to do is to obtain a drawing of the place, either from the owners renting it, or, if the place be bought, from the previous owners, or by having the draftsman sketch it up. In these plans particular attention should be paid to columns, height of ceiling, and location of cross beams, as well as the location of the windows. The location of the cross beams is very necessary in order to be able to arrange the counter-shafts correctly, and as for the columns, it is plainly in evidence that it would be inconvenient to have one of them located right in between the ways of a lathe. The same applies to the planning of closets in front of the windows, which mistake is often made in the drawing, if the windows are not plainly marked When all these data are obtained, a plan should be laid out to as large scale as convenient. It is preferable to paste the paper on which this plan is laid out on the drawing board itself Templet corresponding to the various machines i. the shop should then be cut out of stiff cardboard, these templets being made as close to scale as possible of the actual floor space occupied by each machine Particular attention should be paid in this instance to proper clearances, and the pasteboard pieces should be large enough to cover all projections or overhanging parts of the body of the machine, as these parts often will require larger space than do the columns or feet of the machine. Templets should also be made for benches, closets, and all other fixtures required to be installed. When this is done, the superintendent and the foremen in charge should arrange the templets as they consider best for carrying out the ork in the most economical manner. When the templets have been arranged in a manner satisfactory to everybody concerned, thumb-tacks may be stuck to each templet as it is placed in position, and then another layout can be drawn up very easily, a tracing made, and blue-prints taken, so that everybody concerned in the moving can use one of these blue-prints as a guide

One of the greatest troubles met with is the lining up of the shafting and the placing of the counter-shafts, which, if not properly done at first, will cause an endless amount of trouble later on. A great deal of this difficulty is, of course, avoided in the more modern shops, where individual motor drive obviates this difficulty. Another very important point to be considered when all machines, benches and shafting are placed in position is the arrangement of the lighting fixtures, whether the lighting be by gas or electricity. This work should not be entered upon before everything else is in place, as one of the most important things in regard to light is that it be placed exactly where it will be needed the most, and this cannot very well be determined in the drafting room, but should be determined directly in the shop, when all the machines are in place.

Some shops will think it advisable to hire a few extra hands for the moving, but generally this is bad practice if it is possible to go along without extra movers. Hiring outside help for moving gives the men in the shop a chance to say that they "were not hired for moving," and may retard the work rather than facilitate it. Besides, in the case of moving it is a difficult matter to have too many men to look after, and the experienced old hands will probably know more about how to do the work properly than would extra hands. When everything is arranged right, each machine should be moved from its old place and put directly into its place in the new shop in the same order as it is moved. It is a great deal better to have each machine put in place at the time of moving than to have them all piled up and sorted out later, and if a man with a blueprint of the layout of the floor is appointed to superintend the placing of the machines in position as soon as arriving in the new place, it is an easy matter to attend to The entire operation of moving can be more quickly accomplished if two crews are employed, one to take the machines from the floors and place them on the wagons at the old shop and one to take them off the wagons and put them down in their place in the new shop Thereby the time lost by the men travelling forth and back between the two shops is saved. If the moving is carried on along the lines indicated, and superintended in a proper manner, the interruption in business will not be noticed by outside customers as each machine can be kept in running order up to the time of its removal, and be put in running order within a short time of its being placed in the new shop.

In the case of moving a shop, it is, perhaps more necessary to create a spirit of co-operation among the men than it is at any other time, and to obtain this, many firms offer a bonus to the men for every day under a certain time that the shop is in running order, the bonus to be divided between the men in proportion to the work and responsibility assumed by each at the time of moving. This never fails to impart new energy to everybody, and even the office boy is imbued with new vigor in getting a shop cat into a bag to be taken to the new place. After the shop has been moved, the office quietly goes the same way as the shop The main point to be considered in moving the office is to keep track of all records, as it often happens at the time of moving offices that old, and presumably useless, records are thrown away and lost.

THE FOUNDRYMEN'S CONVENTION.

According to the expectations of Dr R Moldenke and H. M. Lane, representatives of the American Foundrymen's Association at the convention of that body, which is to be held in Toronto next June, will be one of the biggest industrial gatherings ever held in Canada.

At a meeting called in Toronto by I I Anthes, of the Toronto Foundry Co., who is vice-president of the organization, Messrs Moldenke and Lane placed before local foundrymen in and near Toronto, a statement of the work to be done at the convention also of its needs.

As leading foundry supply houses from all parts of the United States and Canada will be making exhibits at the convention a large exhibition building was necessary. The premises for such a display were available in the Machinery Hall and Process Building at the Exhibition Grounds. Permission to use these for this purpose has been secured. From $30,000 to $40,000 will probably be spent by the exhibitors and the association.

It is estimated that from 1,500 to 2,000 foundrymen and foundry foremen will attend this convention, which is admitted to be the greatest educative force in foundry practice in America.

Mr. Anthes is chairman of the local committee, making preparations for the convention.

A. BERG & SON SECURED WORKS.

A. Berg & Son, who have already won recognition throughout Canada as makers of the famous "Berg" brick press and other brick machinery, have bought from the Canadian Shipbuilding Co., the plant and works at the foot of Bathurst Street, Toronto. A description of the plant and of the changes to be made by A. Berg & Son will appear later.

Foreign Trade and the Financial Stringency.

By George D. Griffin.

The increasing financial stringency is a question of surpassing importance worthy of the fullest consideration. The comments of the press so general in Canada and other countries show that the cause of the scarcity of money is in many minds a yet unsolved problem, the result of want of the information that will herein be presented.

Excess Imports.

Is not the cause of the financial difficulty the result of imports in excess of exports to pay for them? This difficulty B. E. Walker, Esq., now manager of the Bank of Commerce, in his address to the stockholders at their annual meeting, November, 1905, (reported in The Monetary Times of January 12, 1906) in his anxiety in relation thereto said that the excess was a mortgage upon the Dominion. In the Toronto News of August 21, 1907, quoting from the current Quarterly Review, it reported that Canada's debt to Great Britain was now over $1,224 million. The government returns prove that in round numbers the amount is the same as our imports in excess of exports since 1850, not a dollar of which has been paid, and in round numbers we have paid about $1,250 millions of interest thereon, and are still paying interest. The fact is confirmed by The Toronto Globe about the same date as The News that our present payable debt to Britain is $60 million annually, that is an average of 5 per cent. on the amount. The 60 million is an average of about $50 per family for the 6 million population of Canada for money to pay interest on imports in excess of exported earnings to pay for them. This indicates one cause of the scarcity of money.

A Worse Exhibit

The total imports for the past five years as given in the government returns is $1,512 million, and the exports, $1,167 million. The excess is $345 million at invoice prices, and which B. E. Walker describes as a "mortgage" upon the Dominion. It is that much of the $1,224 million debt for excess imports above cited. The $345 million is an average of $288 of Dominion mortgage per family in five years upon the 1,200,000 families in the Dominion. The bank returns show that they furnished the importers over $200 million of the amount in gold and on which the importers had paid no interest from Canadian earnings. Nevertheless the banks to-day have much larger vital assets than a year ago. No wonder B. E. Walker in his report in The Monetary Times of January 1908 said that the mortgage the importers were living on Canada was increasing too fast. Is it any wonder that the borrowing and wronging for more money otherwise than from the banks by so many importers to cover the balance is making money scarce?

From the United States.

The government returns show that the excess imports from the United States in the five years in excess of what they purchased of us that we could, and under wise legislation would have made in Canada, was fully the excess of our exports for the five years, and that for them our importers poured the $345 million, or nearly $70 million a year into the lap of the United States to pay their workmen to make goods for Canada, thus depriving their customers, for whom they imported, of work and ability to purchase and pay for their imports. This is amply proved in the $200 million which they have borrowed of the banks and for which, as yet, the bank returns show that too many of them have not paid any interest from Canadian earnings.

Tariff Tax Therein

The tariff government added to the $345 million is estimated to be about $86 million, which the people would not have to pay if the goods had been made in Canada. The simple way to reduce the tariff tax increases is by purchasing goods made in Canada, and this be done without reducing the duties on our imports, but therewith increase them up to the level of the United States tariff, which is about 50 per cent higher than ours. Is it any wonder money is scarce?

Currency Per Head.

The United States returns for 1904 show that they had $30.77 per head of currency, or $153 per family, and that for the previous four years it had increased $3.43 per head or $17.15 per family. In 1901 Canadian bank circulation was only $9.12 per head. In six years to July 31, 1907, it only increased to $12 per head, or to a total of nearly $76 million, or say $61 per family; whereas in the United States it was $153 per family in 1904. The bankers under our system of currency cannot prevent the importers from draining them of gold and the country of currency. And in the wisdom of their ignorance the importers believe they are building up Canada. The Globe has the same belief, for it is only a few weeks since it said to them: "Now is the time to import," just as it said in February 18 and 19, 1864, that the country that did not export in excess of import, "Would involve itself in ruin." There are several known methods to stop the unwise importers from gleaning Canada as in 1877-8 for cash to pay for $186 million of excess of imports in six years, caused the financial crash in which the losses were $400 million. Our government knows not how to countervale the evil, for Sir Wilfrid Laurier in his budget speech, if memory serves, in 1905, said our excess imports were paid for by the profits on our exports after being sold. That is high finance.

When Canada buys from the United States $345 million of goods in five years that it can make, it gets the goods and the United States the money. Had Canada made the goods, as it could and would have done under wise legislation, it would have the goods and the money too, and thus in five years would have increased our wealth $345,000,000, and have no increase of debt.

Excess of Imports for 1907.

The sum of our excess imports for 1907 was $109 million—practically the excess was all from the United States, and in this one year while our banks by the unwise importers prevented from increasing our bank circulation even $1 per head that is $6 million, the importers with Canadian money increased that of the United States $109 million. That is $20 million more money in one year than the cost of the trunk line of the Canadian Pacific Railway to Vancouver. Is it any wonder money is scarce?

The Farmers Interested.

The industrial census returns of the United States in 1870, after the close of the Civil War, when wages were high, were collected by the United States Emigrant Commissioners who showed that the average earnings per head of the whole population was $100, and they are not more in Canada now, and that one-half of that amount or $250 per family was paid to the farmers for their products to feed them, and the other $250 to the balance of the people. The exhibit applied to Canada proves that one-half of the $109 million paid by the importers to the United States last year went to the farmers of that country to purchase food for the workman who made goods for Canadian toilers, the Canadian importers thus deprived their Canadian customers of work and ability to purchase and pay for the goods they imported. Under wise legislation our Canadian farmers would have received the $54 million for their products in place of the farmers of the United States. These facts also show that for every ton of Canada "bonused" iron the Canadian farmer got half the price of the iron for farm products; if made in the United States their farmers get it.

The Tariff Problem.

The increases in Sir Wilfrid's tariff protection which so large a number of his supporters have been told by Mr. McEwen, president of the Farmers' Association, at their last annual meeting, was a "reduction" of tariff, while it has been a raise of the Conservative tariff from $18.95 per family to $38.95, that is $20 per family or more than five times as much as Conservative increase in 18 years from $15 to $18.95 per family, all but a mere rag-a-telle of which has been spent for increased cost of government, therefore the increase of tariff which should be for protection to our industries, has practically been no advantage to them. The excise revenue has increased $3 per family in nine years. Excise is a Government tax on home production and adds that amount to the cost of living and which is thereby an indirect $3 bonus to the foreign manufacturer, and which added to the Government tax makes a $6 curse upon Canadian industry. The excise collected is now $12,000,000 annually, therefore this Canadian bonus to our foreign competitors is equivalent to $24 million annually. Is it any wonder that our industries more or less stagger under such legislation?

Preference Folly.

A preference to Britain or to any other country that is not counter-balanced by a preference to Canada is an indirect bonus by Canada to Britain and any other countries. Last year if the preference was on all the dutiable imports from Britain, which was over $68 million, the bonus in this way to Britain was about $22 million and like the "horse leach" its shoddy manufacturers, whom it benefits the most, are crying for more and more preference, whereby they can undermine Canadian woollen workers, and as shown in the Toronto Globe of June 27 or 28, at the foot of its list of manufacturers that in the last five years over $3,400,000 of capital had been lost in the woollen industry.

This draining of the country of currency naturally increases the rate of interest, an increase of 12 per cent. is estimated to on the average eat up half the net profits. This, the writer is prepared to prove from Government returns.

Fraudulent Goods

The Canadian Government wisely more or less inspects our exports to prevent and punish any "black sheep" whom they find exporting damaged or fraudulent goods, that they shall not defraud foreigners, but where are the inspectors in Canada for inspecting the shoddy and other fraudulent goods imported that would be dear as a gift and for more than fifty years have averaged from 15 to 20 per cent., or a total of from $600 to $800 millions, and which is embraced in the $1,224 million of debt we are paying interest on? It is thus amply proved that in this respect the legislation for Canada has through all these years been more beneficial to foreign countries than to our own people. Is it any wonder that there is a scarcity of money and no financial light secured, only a hazy search among other nations to find where the difficulty originates, while as above seen the origin is in Canada, and Canada the only one to remove the curse, and so in part do so by effective legislation against the entry into Canada of all worthless, shoddy, and other fraudulent imports?

It can from the facts above presented clearly be understood that it is not the importers of necessary good goods that are responsible for the present scarcity of money for industrial purposes. (Scarcity for stock jobbing is another matter altogether), but the increase by importers of the huge $600 to $800 million of worthless goods and interest therefor are responsible for the stringency, and as the same class were for the scarcity which created the financial crashes of 1857-8 and 1877-8, in which so many importers who furnished such goods were swallowed up in the financial wreckage they created.

There are precedents on record in other countries of the methods which they adopted to remove such evils and which secured relief for them from currency stringency. Why should not members of Parliament look them up and follow their examples before we have another financial crash?

Making Soft Steel in the Electric Furnace.

A Development of the Lash Process.

Following our history of "The Iron and Steel Industry in Canada," which appeared in our issue of January 3, comes an announcement of a development calculated to materially influence the history of iron-making in Canada in future years.

The Canadian Lash Steel Process Co., Limited, an Ontario organization with prominent Canadians as well as United States capitalists interested, has been organized with capital of $100,000 and will have in operation within a month or so the largest electric furnace for the making of soft steel yet built.

This company has purchased a building at Niagara Falls, N.Y., and is installing therein a fully equipped steel plant, to be operated in connection with a 1,000 h.p. Heroult furnace, for the purpose of making steel by the Lash process.

The Lash process consists of making a mixture of concentrated magnetic ores, or iron ore sands, granulated pig iron and carbon, and charging the same into either an electric or O.H. furnace and producing steel. It is not a direct process in the strict sense of the word, but is an ore and pig process, the ore, however, being greatly in excess of the amount of pig iron used, and practically eliminating the scrap, using only such scrap as is made in the regular operation of a steel works.

The amount of pig iron required to make a ton of steel, is computed to be less than one-half of what is required in regular O.H. practice, when the mixture is used in an electric furnace, on account of its non-oxidizing atmosphere; this feature, coupled with the fact that the rest of the mixture is iron ore, which is, of course, metallic iron in its cheapest form, will produce a ton of steel ingots at a price much lower than they are produced in regular practice, either in the United States or Canada, figuring the electric power required at its regular market price as sold in large quantities.

Canada, beyond a doubt, with its vast deposits of magnetic ores and iron sands, and its water powers, should be able through the development of this process, to become one of the largest steel producing countries, and command an immense export trade; and this company having previously made a number of experiments on a moderate scale, in which the results were most gratifying, have installed this large plant for the purpose of making a practical demonstration on a commercial basis. The plant was located at Niagara Falls, N.Y., solely for the purpose of gaining time, they being able at this location to immediately procure a building, transformers, and the power required for their installation.

The supervision of the plant is under the immediate direction of Messrs. FitzGerald & Bennie, of Niagara Falls, N.Y., and Robert Turnbull, of St. Catharines, Ont., the Canadian representative of Dr. Heroult, whose furnaces they will install.

Arrangements are being made with two of the best metallurgical and electrical experts in the world, one from England, and one from the United States, to examine into the proposition, and make a full report on the process. These experts will have every facility afforded them to watch the operations, as the plant as before stated is being erected complete, with its laboratories, cranes, casting pits, etc., so as to operate night and day at a capacity of from 25 to 30 tons of steel per day. The steel after being cast into ingots, will be sent into Canada to be rolled, and not only its chemical combination ascertained, but also its physical qualities, and the steel will be shipped into the regular channel of trade.

Mr. Horace W. Lash, the president of this company, and the inventor of this process, has been connected for years with the steel making industry, and it was only after a long series of tests conducted by himself, and a number of demonstrating heats made in the regular O.H. practice, that he permitted the process to be advanced as a commercial proposition. As to its use in regular O.H. practice, there seems to be no doubt as to its results.

Repeated tests showing a yield above the average, a *quality of steel entirely* to factory, and a conversion cost not to exceed regular practice. Then it has been clearly shown that a better quality of steel is made when the same is produced direct from the ore, instead of through the scrap and pig process.

In the electric furnace, the quantity of iron required is very much reduced, owing to its being smelted in a non-oxidizing atmosphere; as pig iron is the most expensive material used in the making of steel, the reduction of its proportion results in a corresponding saving, and when the use of the pig iron is coupled with the ores themselves, the cost of producing a ton of ingots is much lower than the best practice ever brought out.

This process is, of course, a most interesting development for Canada, which country does not possess the required fuel but does possess the water powers and the raw material; therefore, the results resulting from these experiments will be most interesting, and we are promised a copy of the results after the plant is in operation.

TESTS OF SIZING IN PAPERS.

From Kuhlow's German Trade Review.

It is quite difficult exactly to explain what is meant when it is said of a paper that it is perfectly sized. It is, indeed, no use to try to get an accurate rule for this purpose. On the contrary, the uncertainty of the definition has a very important *practical meaning*. This is well worth consideration, and I want to point out moved hereby only by practical reasons.

With the degree of sizing of a paper usually meant, how the paper is against writing ink, and it can consequently be called ink resistance. In this sense *the degree of sizing* covers a certain the general resistance against the penetration of fluids. In the practical life, however this high resistance against fluids is not used exclusively; this is not even asked for as, for instance, in printing papers where the experience has taught that ink papers do not belong to the papers most suitable for printing.

On account of this it has been found practical to agree upon several degrees of sizing which are mentioned as ¼, ½, ¾. The quantity of size is not the only factor which determines the result. It can happen that a paper with half the quantity of size better sized than another with the double quantity. The degree of sizing for writing has meant the resistance against liquids generally.

At present, when paper is used for many different purposes, liquids of the most different kind are brought in contact with it, and many of them should not, or only partly, be allowed to enter into the paper. Consequently, the demands for resistance against liquids have been multiplied. Colored papers, wall papers, light printing papers, photographic papers must show a very high grade of resistance against the materials used in their special treatment. It is therefore not only a question of complicated sizing

tion of mostly not neutral reaction, but sometimes mineral acids, which, though dilute, still attack the fibres. Nobody could expect that the resistance against all the liquids could be compared with the resistance against ink.

A preliminary test will probably always be made with ink, mainly because it is so easily executed, as everybody has this fluid at hand. It is true, that there are big differences between ink and ink, as far as its penetrating qualities, and, besides, ink does not keep in the air without alterations. Ink is also nearly exclusively used as a testing agent in estimating low sizings, and in the same way, using a pen, as with writing papers, though it is only possible to find out great differences in this way. In the following will be shown that also finer differences in the sizing can be ascertained with ink, and, also, how such a test is to be executed.

It is quite wrong to use this test to get an opinion of papers, which, when used, never will be exposed to any liquids, and also to judge the degree of sizing from their behaviour against ink. So, for instance, with printing papers where only printing inks, that is, only liquids, can come in consideration. It could not be supposed, and was from the beginning improbable, that oily and watery liquids should act in about the same way, so that it could be possible to judge the resistance against oily liquids from that against watery liquids.

Special experiments have been carried out to ascertain the penetrating power of oily liquids in paper, and especially of printing varnish, and they have left no doubt that the absorbing capacity for oils is not, or at least very little, lessened on account of the rosin sizing, as compared with the absorbing capacity for watery liquids.

The experiments have shown that the most important factor is the density of the paper. Any special material for the lessening of the absorption of oils is hardly necessary. This depends upon the fact that the paper is rapidly and completely soaked by watery liquids, but only slowly and with difficulty by oily liquids, which, for instance, can be seen in the high resisting powers of parchment paper against oils and fats.

SAND BLASTS IN BRIDGE PAINTING.

From Railway Engineering.

The application of the sand blast in the case of repainting steel bridges has considerably reduced the cost of labor and made possible better results by thoroughly removing all foreign materials from the steel. In order to obtain the best results out of any paint it is essential that all the bridge members be free from rust, scale, dirt, greases, etc. Prior to the use of sand blasts, the usual method of cleaning bridge members was by hand. The method was unsatisfactory for the reason that the cleaners could not clean as much surface as the painters could paint. Consequently, the tendency for the cleaners was to neglect their work in order to keep up with that of the painters. This practice was especially injurious in breaking the continuity of the paint and allowed the moisture from the atmosphere to come in contact with the metal. On this account oxidation of the steel occurred in places where the paint remained intact.

In the use of the sand blast experience has taught us that, for ordinary work, an air pressure of 80 pounds per square inch is ample and efficient, removing all objectionable substance from the steel. Comparative tests with different air pressures using the same size of nozzle, were made with the following results: At 60 pounds pressure, the rate of cleaning was 10 square feet in 7 minutes or nearly 1½ square feet per minute; at 80 pounds, it was 10 square feet in 3½ minutes or 3 square feet per minute, and at 100 pounds, it was 3½ square feet per minute. These tests have shown that the 80-pound pressure previously mentioned, gave the most economical working pressure. To secure the best results, this pressure should be constant, and, in case the air supply is taken from the main that supplies other injectors, it is good practise to install a small receiver about 18 inches by 36 inches in the air main. This receiver has a tendency to give a steady pressure and to catch any condensation from the air. The condensation can easily be drawn from the receiver.

An advantage of sand blasting is that it secures strong adhesion of the paint on account of the thoroughness of the cleaning, especially upon metal surfaces that have been pitted by rust. Re-entrant angles and difficult corners that cannot be reached by hand are also readily cleaned by this method.

INDEPENDENT CANNERS' ASSOCIATION.

At a meeting held in the King Edward Hotel last week about forty canning concerns organized "The Independent Canners' Association," the object of which is to meet for discussion of matters relative to the interests of canning industry.

The officers elected by the Association are:

President—E. D. Smith, Winona, Ont.

Vice-pres.—A. Baker, Old Homestead, Picton, Ont.

Sec.-Treas.—R. W. Ball Essex Canning Co., Toronto.

Executive—F. G. Lowe, of J. H. Withey & Co., of St. Catharines; W. Eckhardt, of Gorman, Eckhardt & Co., London; S. E. Mahan, of the Farmers' Canning Co., Bloomfield; and George E. Fisher, of the Burlington Canning Co., Burlington; legislation committee, M. F. Smith, of the Oshawa Canning Co.; W. A. Carson, of the Napanee Canning Co.; and H. T. Reason, of the St. Thomas Canning Co.

The association commenced its history by an excellent recommendation approving of strict Government inspection of canning factories but urging that inspectors be instructed to name the place found in unsanitary condition and not, by speaking generally, throw suspicion on a whole district.

THE RATING OF GASOLINE ENGINES

The following question and reply which appeared in the November issues of "Gas Power," throw light on a point which buyers of small unit engines should always take in consideration.

Question by "J.P.," Colsbn, Ont.: Why is a gasoline engine not built as strong to the h.p. as steam is? I have a gasoline engine, 12 h.p., and it is no stronger than a 6 h.p. steam engine.

Answer. The unit brake h.p. is exactly the same in the gas as in the steam engine. But the manufacturers of gas or gasoline engines do not rate them the same as steam engine manufacturers do. The steam engine builders rate their engines say under 60 pounds boiler pressure. That is, if a new engine will show 6 h.p. on the brake test when the boiler pressure stands at 60 pounds, or with 60 pounds of steam, the engine is rated and called a 6 h.p.

You can easily see how this same engine would show 12 h.p. on brake test if 120 pounds of steam were carried, or 18 h.p. at 180 pounds steam.

The gas or gasoline engine you refer to was probably pulled to its utmost capacity and showed 12 h.p. on the brake test and was then rated at its full capacity and called a 12 h.p.

The steam engine is limited in power only by the steam pressure at which the boiler is safe. While the gas or gasoline engine is limited to the extent of the pressure to be had from the explosive force or combustion of gases within the cylinder.

Gas or gasoline engines are usually rated at their showing on the brake under full load. They are given their highest rating, while steam engines are rated at all they will pull under 60 pounds of steam, regardless of what they will do at 120 or 180 pounds.

Consequently the steam engine is underrated when the higher boiler pressures are considered.

PERSONALS.

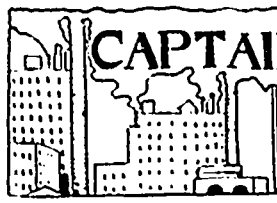
Mr Warren Chambers, who for ten years was with the Fairbanks-Morse Co., the last two of which were with the Canadian works at Toronto, has acquired an interest in Automatic Products, Limited, Orillia, Ont., and will take charge of the practical end of their business.

Mr D. S. Perrin, president of D. S. Perrin & Co., Limited, manufacturers of biscuits and confectionery, London, Ont., died last week.

Robert W. Hunt & Co. have established their St. Louis office, which is in charge of Mr C. W. Gennet, jr., at 1445 Syndicate Trust Bldg. They have arranged to locate their chemical and cement laboratory in the same building.

The many friends of Mr. W. J. Elliott, St Catharines, Ont., will be glad to know of his appointment as manager of the Whitman & Barnes Mfg. Co., St. Catharines, Ont. Mr. Elliott entered the employ of that concern as a junior fifteen years ago and has steadily moved upwards, his present promotion being from the sales department. Mr Elliott will have the counsels and support as assistant manager of Mr. George Burch, one of the original founders of the concern and one of the largest stockholders. The firm will continue to devote all their time to the lines for which they have already won desirable reputation in all parts of Canada, namely mower and reaper knives, wrenches, twist drills, reamers, hammers of all kinds, woodworking, paper and special knives.

Mr. Roland Yeates, of the London Machine Tool Co., Hamilton, left on Thursday for Montreal, where he will open a sales office for that company.



CAPTAINS OF INDUSTRY

The following items of information, which are classified under the title "Captains of Industry," relate to matters that are of special interest to every concern in Canada interested in any manufacturing industry whatever, this interest extending to supply houses also.

The Canada Chemical Mfg. Co., of East London, Ont., have decided that in the future their entire product will be manufactured in "Sulphide Ontarion," Hastings, Ont., where a mine has been discovered in which iron and sulphur are in such proportions that the company can produce sulphuric acid much more cheaply.

The Canadian Concrete Co., a branch of the American Concrete Co., of Chicago, Ill., will establish a plant in Windsor, Ont.

The Canadian Pacific Railway Co. will add 300 feet to their freight sheds in Port Arthur, Ont.

The city council, Belleville, Ont., have decided to erect an isolation hospital.

The Lake Sand & Gravel Co., Toronto, have been incorporated with a capital of $10,000, to carry on a contracting and constructing business. The provisional directors include H. W. Maw, G. S. Hodgson and W. J. McKay, Toronto.

The Manitoulin & North Shore Railway Co. are asking for an extension of time for the commencement and completion of the construction of their line of railway.

The new waterworks system, New Liskeard, Ont., was put into commission a few days ago.

The city council, Port Arthur, Ont., are considering the erection of a public hall and opera house.

The Bay Lake & Montreal River Mining & Development Co., Sault Ste. Marie, Ont., have been incorporated with a capital of $300,000, to carry on a mining, milling, and reduction business. The provisional directors include W. A. Pollock, W. O'Brien and M. Cahill, Sault Ste. Marie, Ont.

The flour mill of the Lakefield Milling Co. and the planing mill of F. J. Moore & Son, Lakefield, Ont., were destroyed by fire, January 22. Loss about $35,000.

At a recent meeting of the Electrical Construction Co., London, Ont., the following directors were elected: Geo. Olmstead, president and treasurer; Thos. Deeley, vice-president, E. I. Sifton, manager and secretary, and J. MacPherson, solicitor.

Imperial Gold Mines, Limited, Toronto, have been incorporated with a capital of $4,000,000, to carry on a mining, milling and reduction business. The provisional directors include J. G. Shaw, J. Montgomery, and W. R. Williams, Toronto.

The premises of the Slater Shoe Co., Toronto, were damaged by fire, January 20. Loss about $15,000.

The saw and planing mill of Craig & Austin, Kinmeunt, near Lindsay, Ont., was destroyed by fire recently. Loss about $12,000.

The Standard Implement, London, Ont., have been organized with a capital of $60,000, to manufacture farm implements. A new factory will be erected in Chelsea Green, Lindsay, in the spring.

The R. T. Booth Co., Fort Erie, Ont., have been incorporated with a capital of $25,000, to manufacture drugs, medicines, etc. The provisional directors include A. N. Drake, J. C. Orr and C. B. Miller, Buffalo, N.Y.

H. E. Ledoux & Co., Port Arthur, Ont., have been incorporated with a capital of $100,000, to manufacture tobacco, etc. The provisional directors include J. J. Carrick, D. Hogarth and J. P. Mooney, Port Arthur, Ont.

The premises of East & Co., trunk manufacturers, Toronto, were damaged by fire, January 18. Loss about $5,000.

The storage warehouse of M. Rawlinson, St. Joseph Street, Toronto, was destroyed by fire, recently. Loss about $500,000.

The Time Saving Coupler Co., Toronto, have been incorporated with a capital of $50,000, to manufacture metal hose couplers, etc. The provisional directors include H. L. Plummer, H. E. Johnston and R. Musgrave, Toronto.

The premises of McLaren's, Limited, Hamilton, Ont., were damaged by fire, January 18. Loss about $10,000.

On account of the present financial stringency, the Canadian Shipbuilding Co., have decided to sell their machine shop at the corner of Bathurst and Front Streets, Toronto, to A. Berg & Sons, brick machinery manufacturers, Toronto. The shop is valued at $140,000.

The ratepayers of Kenora, Ont., carried a by-law in favor of a street railway.

Moore & Browne, Limited, Sault Ste. Marie, Ont., have been incorporated with a capital of $100,000, to manufacture plumbing, engineering, electric, gas and waterworks' supplies. The provisional directors include R. Moore, J. D. H. Browne and W. H. Hearst, Sault Ste. Marie, Ont.

The capital of the Crown Furniture Co., Preston, Ont., has been increased from $40,000 to $100,000.

The Windsor, Chatham and London Railway Co. are applying for an extension of time.

The high pressure system, Toronto, will be ready for operation the early part of this month.

It is reported that negotiations are in progress between the Turbine Steamship Co., Toronto, and the Michigan Central Railway, whereby the former company may gain control of the Michigan Central's Niagara River line, and thus secure quick connections for their passengers to Buffalo.

The Standard Brass Mfg. Co., Sarnia, Ont., have been incorporated with a capital of $20,000, to manufacture brass, copper, tin, tubes, machinery, etc. The provisional directors include W. Brabant, L. Brabant, Detroit, Mich., and F. X. Brabant, Chatham, Ont.

An additional building will be erected in connection with the buildings of the ... winter fair, Guelph, Ont.

The Harris Abattoir Co., Toronto, ... build a water tank at a cost of about $3,000.

The Dineen Mfg. Co., Toronto, have been incorporated with a capital of $75,000, to manufacture clothing, garments, furs, etc. The provisional directors include W. D... W. F. Dineen and F. B. Dineen, Toronto.

J. H. Smith, Toronto, will erect a two-story brick factory this spring at a cost of about $10,000.

The Gendron Mfg. Co., Toronto, intend making alterations to their factory at a cost of about $12,000.

The Ontario Government will erect a galvanized iron experimental plant on Chestnut Street, Toronto, at a cost of about $3,000.

A fire hall will be erected in the northern part of London, Ont., at a cost of about $19,000.

The Stoney Point Canning Co., Stoney Point, Ont., have been incorporated with a capital of $40,000, to carry on a general canning business. The provisional directors include J. Breault, Tecumseh, Ont., and L. Desmarais, Stoney Point, Ont.

The Imperial Trusts Co., of Canada, are considering the erection of an office building in Toronto, at a cost of about $40,000.

Messrs. Brown & Love, Toronto, have been awarded the contract for the erection of the new observatory in that city. The contract price is $90,000.

Excavation has been started for the new four-story factory of the James Morrison Brass Mfg. Co., Toronto, which will be erected at a cost of about $60,000.

The Swastika Mining Co., Toronto, have been incorporated with a capital of $750,000 to carry on a mining, milling and reduction business. The provisional directors include T. Steele, Stratford, Ont., and M. Stock, Tavistock, Ont.

The waterworks system, Palmerston, Ont., will be extended at a cost of about $8,000.

The Canadian Pacific Railway, Canada Northern Railway and Grand Trunk Pacific Railway are unanimous in asking that the McKay and Kakabeka Railway Co. construct overhead bridges or subways at the West Fort crossing, Port Arthur, Ont. The steam railways prefer subways as bridges might interfere with the signals.

The Department of Railways & Canals, Ottawa, invite tenders up to March 12 for the works connected with the construction of section No. 3 Ontario-Rice Lake Division of the Trent Canal.

The Royal Bank of Canada have opened branches at Burk's Falls, Clinton and South River, Ont.

The Northern Foundry & Machine Co., Sault Ste. Marie, Ont., are starting a foundry and machine shop to do all kinds of repair work. They expect to be running early next month.

The Fire & Light Committee, Port Arthur, Ont., will call for new tenders for [illegible].

The Traders Bank of Canada have opened a branch at Mount Forest, Ont.

The new molding shop of the Canada Thompson Pipe & Foundry Co., Port Arthur, Ont., has just been completed. The [illegible]

ng shop is designed to do jobbing work and small repetition work for their pipe foundry. The management are considering the installation of molding machines.

At the annual meeting of the shareholders of the Goold, Shapley & Muir Co., Brantford, held January 18, it was decided a new machine shop 132x54 feet, should be erected during the present year, and also a wood shop 100x54 feet. The machine shop will be equipped with a travelling crane.

The Collingwood Shipbuilding Co., Collingwood, Ont., have resumed operations, being closed down during January.

Wickson & Greig, Toronto, will erect a brick factory at a cost of about $16,000.

F. V. Newell, Chicago, has prepared plans for a large summer hotel, which will be built on Newel Island, about five miles from Kenora, Ont., during the summer months.

A large portion of the plant of the Canada Tin Plate & Sheet Steel Co., Morrisburg, Ont., was destroyed by fire, January 27.

The Canadian Packing Co., London, Ont., have been incorporated with a capital of $199,000, to carry on a general packing business. The provisional directors include E. Rechnitzer and M. D. Fraser, London, Ont.

The Canada Southern Oil & Gas Co., Tilbury, Ont., have been incorporated with a capital of $100,000, to manufacture oil, gas, etc. The provisional directors include J. A. Tremblay, B. Ballard and H Callwood, Tilbury, Alta.

The Canadian Writerpress Co., Hamilton, Ont., have been incorporated with a capital of $30,000, to manufacture duplicating writing presses The provisional directors include J. Kneeshaw, A. P. Vanfleet and C P. Heal, Hamilton, Ont.

The Great West Coal Co., Port Arthur, Ont., have been incorporated with a capital of $250,000, to carry on a mining, milling and reduction business. The provisional directors include J. J. Carrick, J. A. Crozier and P. D. Munro, Port Arthur, Ont.

Collingwood Hardware, Limited, Collingwood, Ont., have been incorporated with a capital of $10,000, to manufacture hardware, household furnishings, etc. The provisional directors include W. D. White, F. W. Gregory and R. H. Breeze, Collingwood, Ont.

T E. Bissell Co., Elora, Ont., have been incorporated with a capital of $150,000, to manufacture tools, agricultural implements, etc. The provisional directors include T. E. Bissell, F. G. Hunt, Elora, and R. Ewing, London, Ont.

The premises of the American Hotel, Gananoque, Ont, were destroyed by fire, February 2. Loss about $2,000.

The Hamilton & Barton Incline Railway Co., Hamilton, Ont., have placed an order for two new steel cars.

Mr. A. J. Lindsay, Toronto, is installing three of his belt transmitters in the factory of Seaman-Kent Co., Meaford, Ont.

The Chatham Motor Car Co., Limited, Chatham, Ont., have assigned in trust to Ward Stanworth.

The Rapid Tool Co., Peterboro, Ont., have suffered loss by fire.

The Canadian Fire Engine Co, London, Ont., have assigned to the Canada Trust Co.

An order to wind up the Canadian Shipbuilding Co., Toronto, has been granted. E R. C. Clarkson is liquidator.

The Dominion Chemical Co., Sherbrooke, Que., have been incorporated with a capital of $100,000, to manufacture chemicals, etc. The charter members include C. W. Cate, E B. Worthington and W. Farwell, Sherbrooke, Que.

The Geo. Belanger Co., Montreal, have been incorporated with a capital of $45,000, to manufacture agricultural implements, waggons, vehicles, tools, machinery, hardware, boilers, harness, furniture, etc. The charter members include J. A. Daoust, G. Belanger and T. Bedard, Montreal.

The silk waist factory of J. Mishkin & Co., St. James Street, Montreal, was damaged by fire, January 17. Loss about $5,000.

The Terrano Flooring Co., Montreal, have been incorporated with a capital of $100,000, to manufacture flooring materials, etc. The charter members include H E. B. Smith, K. F. Lockhart and W. L. Bond, Montreal.

The Benallack Lithographing & Printing Co., Montreal, have been incorporated with a capital of $400,000, to carry on a lithographing and printing business. The charter members include A. R. Oughtred, W. de M. Marter, Montreal, and T. Allan, Lachine, Que.

The convent of St. Anne, St. Remi, Que., was destroyed by fire, January 19. Loss about $50,000.

The Canadian Pacific Railway Co. have placed an order for 400 composite steel and wood freight and ballast cars with the Dominion Car & Foundry Co., at Blue Bonnets, Que., and the contract for the production of the steel required for these cars has been given to the Nova Scotia Steel Co., New Glasgow, N.S.

Mr. Howards, of the city roads department, Montreal, has been directed by the council to superintend the preparing of plans for elevating of the tracks of the Grand Trunk Railway Co., through the city.

The Standard Foundry & Mfg. Co., Longueuil, Que., have been incorporated with a capital of $95,000, to manufacture tools, engines, boilers, machinery, hydrants, valves, etc. The charter members include A. Ameye, M. Baartmans and A. Jodoin.

The premises of the Alexandra Hotel, Buckingham, Que., were destroyed by fire, January 26. Loss about $6,000.

Geo. Roberts, Montreal, is erecting a three story brick, mill construction, building 60x58 ft., at 39 Vitre St., Montreal. The building will be occupied early in February by Hutchison & Sticht, ornamental iron workers.

The Montreal Light Heat & Power Co., Montreal, are fitting up their Chenneville St. station to supply steam for heating purposes to buildings in the vicinity. Insulated underground mains will convey the steam for a distance of half a mile or more. Service will be by meter.

The Standard Construction Co., Montreal, are installing a very modern 500 h.p. electric plant in the La Presse building. The generators will be in three units, two of 150 k.w. and one of 175 kwt., all steam and exhaust piping will be laid in concrete ducts. A slate panel switchboard will distribute the current to the power and lighting mains.

The warerooms of P. D. Dods & Co., 162 McGill Street, Montreal, were destroyed by fire, January 30, the loss being about $65,000. E. Schultz Son & Co., E. F. Wragge & Co., and Frost & Wood also suffered to the extent of $25,000, $5,000 and $500 respectively

The Brayley Drug Co., St. John, N.B., have been incorporated with a capital of $75,000, to manufacture drugs, chemicals, paints, oils, varnishes, etc. The provisional directors include C. E. Farrand, St. John, N.B., J. W. Budd, Halifax, N.S., and H. Gunter, Fredericton, N.B.

Department of Railways & Canals, Ottawa, invite tenders up to February 15 for the lease of car and work shops, together with the siding and shop at Moncton, N.B.

The congregation of the Presbyterian church, Halifax, N.S., will erect a new church at a cost of about $20,000.

The building occupied by Smith & Co. and several other firms, Truro, N.S., was destroyed by fire, January 29. Loss about $10,000.

The city council, Brandon, Man., have passed a final recommendation to construct a reinforced concrete bridge across the Assiniboine River, at a cost of about $[illegible]. The bridge will consist of three 90-foot spans with necessary approaches.

The Minnedosa Power Co., Minnedosa, Man., are seeking permission to dam the Little Saskatchewan River and to raise the water of Clear Lake, in the Riding Mountain Forest Reserve, not more than five feet. This company purpose supplying light and power to citizens of Minnedosa.

The Northwestern Cap Co., Winnipeg, Man., have been incorporated with a capital of $20,000, to manufacture caps, mitts, gloves, etc. The provisional directors include J. Berlin, T. Hurtley and W. [illegible], Winnipeg, Man.

The handsome new building being erected for the Dominion Bank in Winnipeg, has been completed.

The elevator of W. G. Lee, Souris, Man., was destroyed by fire recently. Loss about $9,000.

The Togo Annex, a large building in connection with the Togo House, Winnipeg, Man., was damaged by fire, January 30. Loss about $2,000.

The round house of the Grand Trunk Pacific Co., at Rivers, Man., is being completed. It is stated that the locomotive of the company may be moved from Portage la Prairie, Man., to that place.

The Fusee-McFector's Co., Nepawa, Man., have been incorporated with a capital of $75,000, to manufacture lumber, sash, doors, furniture, shingles, etc The provisional directors include R. H. Fusee, Nepawa, Man., and J. McIntosh, Neepawa, Man.

The Model Mfg. Co., Winnipeg, Man., have been incorporated with a capital of $20,000, to manufacture clothing and

linen, cotton goods, carpets, rugs, etc The provisional directors include J Love, W. J. Dods and W. A. Vrooman, Winnipeg, Man.

The directors of the General Hospital are asking the city of Regina, Alta., to pay over to them $100,000, for the erection of a municipal hospital.

The Dominion Express Co. have opened an office in Lanagan, Sask.

The Bank of Montreal have opened a branch in Magrath, Alta.

The premises of the North Star Elevator Co., Milestone, Sask., were destroyed by fire January 18. About 18,000 bushels of grain were also destroyed.

The station of the Canadian Northern Railway Co., at North Battleford, Ont., was destroyed by fire, January 23. Loss about $5,000.

The May-Sharpe Construction Co. have completed the construction of the second of the two large piers for the sub-structure of the Grand Trunk Pacific bridge across the North Saskatchewan River, at Clover Bar. The pier cost approximately $52,000 and contains about 4,000 cubic yards of concrete.

The civic lighting plant, Calgary, Alta., cleared a net profit last year of $26,000.

The sewerage and waterworks systems, Saskatoon, Sask., will be extended.

A new post office and customs house will be erected by the Dominion Government in Saskatoon, Sask., at a cost of about $100,000.

The Alberta government intend carrying on extensive building operations this year. The list of public buildings include the court houses in Edmonton and Wetaskiwin, the Land Titles Office and the Normal School at Calgary, the jail or court house at Lethbridge, and the asylum at Ponoka, Alta

A Roman Catholic church will be erected in Wetaskiwin, Alta., at a cost of about $60,000.

J. A. McDonald, Nelson, B.C., is considering the establishment of a large confectionery factory in Calgary, Alta.

The Victoria Hotel, Calgary, Alta., was destroyed by fire, January 28. Loss about $10,000.

The Northern Bank will erect a five story building in Victoria, B.C.

The city council, Revelstoke, B.C., are calling for tenders for the construction of a city sewerage system. Tenders are also called for a concrete foundation for the new power plant and for the erection of a city jail.

An appropriation of $2,000 has been made for dredging the channel to the wharf, Salmon Arm, B.C.

The Grand Trunk Pacific Co. will erect a large hotel at Prince Rupert, B.C., at a cost of about $250,000.

An addition may shortly be erected to the postal and customs departments, Victoria, B C.

The British Columbia Agricultural Association, Victoria, B.C., will erect new buildings at a cost of about $50,000.

The Canadian Pacific Railway Co. are contemplating a large amount of bridge work on their main line in British Columbia, where many wooden bridges will be replaced with modern permanent structures.

Messrs. Dalton & Everleigh, Vancouver, B.C., have prepared plans for a sanitorium to be erected near Kamloop, B.C., at a cost of about $50,000

The Canadian Pacific Railway Co. are considering the electrification of many portions of their lines in the Rocky Mountains and British Columbia.

Messrs. Rizutto Bros., Fernie, B.C., have opened a branch in that city.

The Dominion Government have decided to erect a post office building at Grand Forks, B.C., at a cost of about $35,000.

Building permits for January, in Vancouver, B.C., reached the total of $131,800, an increase of $40,000 over those of the same period last year.

The Grand Trunk Pacific Co. have decided to call for tenders for the construction of a section of 100 miles in British Columbia, from Prince Rupert eastward through the coast range. Experts declare that the cost of a great part of this section will be at least $100,000 per mile, and that some miles will even exceed this figure as there will be a large amount of rock-cutting, tunnel and side-hill work

During 1907 the total number of miles of track laid in Canada reached the figures, 1,099. It is estimated that there are 3,000 miles of track under construction at the present time.

ADDING ALUMINUM TO BABBIT.

It is stated that a small percentage of aluminum added to babbitt gives a very superior material over the ordinary babbitt metal. It seems to increase the durability and wearing properties of the metal, and under compressive strain is softer than the common babbitt.

In a certain mill a crank pin bearing of a 30 h.p. engine, with the ordinary babbitt metal required attention about every three days; and after inserting in the bearing aluminium-babbitt strips of about one-half inch width upon the face, dovetailed in alternately in the brass bearing, the same bearing ran under similar work for two months without requiring any attention; and when examined at the end of two months the crank pin was found to have become very much smoother than it was before the aluminum-babbitt had been inserted.

Dovetailing the babbitt in strips is recommended, for the reason that it gives equal bearing all over the surface. Another advantage of this babbitt is its extreme malleability. It can be hammered out to a thin edge without cracking, whereas the ordinary babbitt is not at all malleable. An advantage of this is that for bearings, with aluminum, the babbitt can be rolled into shape for inserting in the dovetailed recesses, as the recesses can be cast and drifted out at very small expense, and without waste of babbitt.—American Miller.

INDEX TO ADVERTISEMENTS.

ifc ..... inside front cover. ibc.....inside back cover obc.....outside back cover.

INDEX TO ADVERTISEMENTS (Continued).

Pages Missing